

THE ENHANCEMENT OF MINDFULNESS THROUGH
FLOATATION-REST IN BEGINNING MINDFULNESS
MEDITATORS

Master of Science in Psychology

University of Canterbury

V. R. Campion

University of Canterbury

2017

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Abstract

Mindfulness is widely used as a psychological intervention and its popularity is continuing to grow. The theory that underpins mindfulness interventions suggests the number of hours spent meditating is correlated with the development of mindfulness levels, which in turn, leads to correlated levels of psychological improvements. Meditation, however, is not the only method for developing mindfulness. Floatation-REST provides an environment with the potential for eliciting and developing mindfulness. The current study sought to investigate whether engaging in Mindfulness meditation in floatation-REST would increase levels of mindfulness beyond those developed in a normal sensory environment. Fifty participants were taught a Mindfulness-based meditation before dividing into a floatation-REST (experimental group) or group-meditation (control group). Participants meditated in their randomly selected conditions seven times for one-hour on a fortnightly basis, while also engaging in daily, 30-minute individual meditations. Mindfulness levels were measured before and after meditation training and then fortnightly throughout the duration of the study. As predicted, mindfulness levels showed significantly higher changes for those who meditated in floatation-REST, compared to those who solely meditated in a normal sensory environment. This result had a large effect size, $\eta^2 = .07$. Post-research analyses showed that both groups engaged in similar hours of individual meditation during the study. These results show that mindfulness meditation in floatation-REST has the capacity to raise mindfulness levels beyond dose-related amounts. These findings suggest floatation-REST is a tool which can be used in conjunction with Mindfulness training to enhance the development of mindfulness.

The Enhancement of Mindfulness Through Floatation-REST in Beginning Mindfulness

Meditators

What is Mindfulness?

Mindfulness can be defined as being aware of and attentive to internal and external phenomena as they arise in the present moment (Brown & Ryan 2004; Mikulas 2015). *Awareness*, refers to the subjective experience of internal and external phenomena. It is the pure apperception and perception of the field of events that encompass our reality at any given moment (Brown, 2005). “Perception” refers to the consciousness of external stimuli received through the five senses, whereas “apperception” within philosophical discourse means the consciousness of internal events and experience (Depraz, Varela & Vermersch, 2000). *Attention* is a process of focusing awareness. It is a hypernym used in cognitive psychology to describe all or some of a set of distinct sub-processes that collectively underlie our ability to attend to different stimuli (Malinowski, 2013; Treadway & Lazar, 2009), allowing for the heightened sensitivity of a restricted range of the reality awareness receives (Westen, 1999). In everyday awake states awareness and attention are interwoven, where attention continually pulls “figures” out of the “ground” of awareness, holding them focally for varying lengths of time for closer examination (Brown & Ryan, 2003; Siegel, Germer & Olendzki, 2009).

Awareness and attention are both relatively constant features of normal functioning within the human organism. During mindfulness awareness and attention are enhanced to the present moment as it is directly perceived (Brown & Ryan, 2003; Kabat-Zinn, 2003) [the word *perceived* will be used to describe the reception of both internal and external stimuli]. Perceiving the present moment is a process in which internal and external phenomena that are received by the sensory organs are observed without the observer engaging in any thoughts or emotional reactions that may arise (Brown & Cordon, 2009; Shapiro & Carlson, 2009). While emotional reactions and thoughts are natural aspects of human functioning, that which allows the user of mindfulness to remain in the present moment is to observe

these activities as psychological and somatic events unfolding, rather than episodes in a narrative or personal drama that the person is actively involved in (Bodhi, 2006; Malinowski, 2013).

Awareness and attention are the primary features of consciousness (Brown & Ryan, 2004). Consciousness is known to serve two key functions: monitoring events and experiences as they unfold in real time, and directing and controlling the contents of consciousness (Westen, 1999). Mindfulness concerns the monitoring, observing capacity of consciousness, and is thus understood by many prominent authors to be an inherent part of human consciousness (Brown & Ryan, 2003; Goldstein, 2002; Kabat-Zinn, 2003).

The study of consciousness, however, is a difficult area. Neuroscience, neurobiology, cognitive science, artificial intelligence and psychoanalysis are amongst the most relevant disciplines for the study of consciousness. Yet all currently provide peripheral accounts and no universally accepted operational definition or description of how it works has emerged. This leaves consciousness, and consequently mindfulness, as areas that are not well understood within contemporary psychology. Baars (1997) suggests this is likely due, in part, to behaviorisms' era of purging concepts such as consciousness from psychological enquiry, as well as the relative novelty of mindfulness as a topic of scientific study. Since these areas of study are currently unable to shed full light on the nature of consciousness nor mindfulness, several authors including Brown and Cordon (2009), and Owen (2013) have recommended reaching an understanding of mindfulness as an inherent human capability with the assistance of the lens of Husserlian phenomenology. The Husserlian school is a long-standing philosophical and psychological scholarly discussion of conscious processing which has attempted to deconstruct human consciousness into its primary modes of processing (Husserl, 1999).

Phenomenology proposes that there are two primary modes of conscious processing, a perspective which has recently gained support from the cognitive science literature (Depraz, Varela, & Vermersch, 2003). Husserl labelled these modes of processing *the natural attitude* and *the phenomenological attitude* (Brown & Cordon, 2009). The natural attitude is the default mode of processing. It is a particular orientation toward ourselves, others and the world in which events are treated as objects

which cognitive operations are made upon. What enters awareness via the mind or the senses is experienced as a sense impression (i.e. image, feeling, sensation) and filtered through cognitive operations, such as evaluation of the sense impression or rumination about it. This cognitive filtering is designed to disclose the content of our experience and, in particular, what the experience means or could mean in relation to me, and it usually occurs automatically in a habitual manner (Brown & Cordon, 2009). Brown & Cordon (2009) emphasize that this mode is similar to what has been called 'second-order processing' (Lambie & Marcel, 2002) and 'propositional processing' (Teasdale, 1999). This is the mode of consciousness in which our reality becomes what we conceive it to be through the formation of mental representation.

Husserl's second mode of processing, the phenomenological attitude, bears striking similarities with mindfulness. In this phenomenological mode, our attention and awareness is turned toward reality as it initially appears to us, that is, before processing. The “stepping back” from our typical way of processing (cognitively appraising raw phenomena) that occurs within the natural attitude and bringing our awareness and attention to the flow of phenomena as it arises is a procedure Husserl termed phenomenological reduction (Brown & Cordon, 2009). In this mode of processing or state of consciousness, where the Husserlian school considers us to be the un-participating observer (Luft, 2004), all things (sense impressions, feelings, images, and thoughts) remain but are perceived in a different way. That is, as they initially appear to awareness (Thompson & Zahavi, 2007 as cited in Brown & Cordon, 2009). The stepping out of the natural attitude is facilitated by a “bracketing” of our habitually conceptual mode of processing, and leaves the mind registering how reality is “constituted” in the present moment within the structure of our conscious minds (Brown & Cordon, 2009). This mode of processing, as Brown and Cordon recognize, is similar to first-order processing (Lambie & Marcel, 2002) and buffered implicational processing (Teasdale, 1999), in that it involves a receptive state of mind with attention kept to a bare registering of the phenomena observed. The following sections will render more salient the similarities between Husserl's idea of natural and phenomenological attitude

modes of conscious processing, the Buddhist approach, and the modern psychological understanding of mindfulness.

The History of Mindfulness

Most of the work on mindfulness within the Psychological literature has been informed by the 2,600-year tradition of Buddhism (Shapiro & Carlson, 2009). This section is not intended to be a complete description of the Buddhist conceptualization of mindfulness but a rudimentary overview of how this concept is understood and approached within the classical Buddhist literature. Mindfulness is central to Buddhism. Given the length of the tradition and the Eastern emphasis on internal examination, the theories and instructions around mindfulness are prolific – or as fruitful as literature on mindfulness can be, given that it is essentially an experiential process. Buddhist writer Gunaratana (1996) wrote “words are devised by the symbolic levels of the mind and they describe those realities with which symbolic thinking deals. Mindfulness is pre-symbolic. Mindfulness could be described in completely different terms than will be used here and each description could still be correct” (p. 13). “Mindfulness,” is an English translation of the Pali word, *sati*, which connotes awareness, attention, and remembering (Siegel, Germer & Olendzki, 2009). Pali was one of the two languages in which the teachings of the Buddha were originally recorded and the language that will be relied on here. Contemporary Buddhist scholars, Analayo (2003) and Bodhi (2006), note mindfulness, in its most simple form, is bare attention or full attention to the present.

The origins of Buddhism are rooted in the experience and teachings of the founder, Guatama, The Buddha (translated as the '*Awakened*' or the '*Enlightened One*'). The Buddha is believed to be an historical person who lived in Northern India in the 6th century B.C. (Dhammananda, 2002). Originally named Siddhartha Guatama, Guatama become known as The Buddha after reaching *enlightenment* at the age of 35. Enlightenment is understood to be a permanent mental state where the suffering related to the erroneous concept of a permanent individual ego has been eliminated, leaving a calm contentment characterized by sustained emotional balance and psychological well-being (Gethin, 2011). It is a state

that is synonymous with the permanent cessation of human suffering, which Buddhist philosophy asserts is caused by ignorance regarding the nature of reality (Siegel, Germer & Olendzki, 2009). Through the example of his own awakening and a later life devoted to training others, the Buddha demonstrated that this internal cause of suffering can be seen, understood and healed (Olendzki, 2009). Olendzki (2009) notes that, “his approach is basically psychological, his methods are mostly empirical, and his goal is ultimately therapeutic” (p. 41), which explains why his teachings have gained the interest of modern psychologists. Buddhism is now responsible for the passing on of the Buddha's path, which mindfulness is a fundamental aspect of. It has been recognized that through the generations teachings have been added to Buddhism which did not originate from the Buddha himself (Loy, 2007). Summarized here is what is understood to be the teachings of the Buddha himself (Dhammananda, 2002).

To understand how the Buddha's path is believed to end suffering it is important to understand what the Buddha meant by suffering. As the Four Noble Truths announce, life is inseparably tied to *dukkha*. This is the word which is often translated as *suffering*. However, modern Buddhist scholar Bhikkhu Bodhi (1984) emphasizes, this means something deeper than pain and misery. Bodhi (1984) suggests a more appropriate description of *dukkha* is a basic *unsatisfactoriness* that runs through the lives of everybody except for the enlightened. This *unsatisfactoriness* sometimes erupts into an experience of sorrow, grief, disappointment, or despair, although it usually lingers at the edge of our awareness as a vague unlocalised feeling that life is not how it should be (Bodhi, 1984). While living in *dukkha*, pleasure and enjoyment may still be experienced but the basic problem remains at the core of our being, and without enlightenment we continue to move within the boundaries of *dukkha*. The Buddha locates the origin of *dukkha* within ourselves, as a condition which causes disorder in our own minds and perverts our relationship with others and the world.

Dukkha is a condition which gives rise to and is perpetuated by unwholesome mental states called *kilesas* (defilements). The fundamental defilement, Ignorance (*avijja*), gives rise to three secondary root defilements; greed, aversion and delusion. From these three root defilements emerge the others, such

as conceit, jealousy, ambition, lethargy and arrogance. According to Buddhism, it is these defilements which lead us to feelings of pain, sorrow, fear and discontent and are considered to be dukkha in its diverse forms. Thus, to liberate oneself from suffering, one needs to dismantle and eradicate these defilements (Chiesa, 2013).

The Buddha taught that if we work on rooting out the primary defilement, ignorance, the latter, resultant defilements will subsequently give way. Ignorance is a state of not knowing things as they really are. The cause of ignorance, according to Buddhism, lies within ordinary consciousness. Ordinary consciousness is understood to interact with present moment experience by becoming aware of a sense impression and, rather than remaining with the present sense impression, it begins a cognitive process that transforms this initial sense impression. The cognitive process that occurs is usually an interpretive one, where the mind seeks to interpret the phenomena, to make it comprehensible via its previously created and conditioned categories and assumptions (Bodhi, 1984; Gunaratana, 1996). Bodhi (1984) describes the process as follows, “the mind posits concepts, joins the concepts into constructs — sets of mutually corroborative concepts — then weaves the constructs together into complex interpretative schemes” (p. 71). Through the process of ordinary consciousness, the original direct experience becomes clouded by ideation and the original object or sense is only dimly observed through layers of ideas, judgements and emotional reactions. The mind perceiving the object with ignorance then projects its internal constructs ascribing them to the object, believing that its own mental constructs belong to the object itself. Thus, what we come to know as the final object of cognition for use in future moments is not the original object that entered awareness. Thus, we are living in ignorance which is both caused by and continues dukkha, our deep, underlying sense of unsatisfactoriness or suffering.

Buddhism emphasises to counteract ignorance; we need to know reality (Gunaratana, 1996). It is emphasised that this is not merely a conceptual knowledge, but perceptual knowledge known as wisdom, translated from the word *pañña* (Gunaratana, 1996). Wisdom, according to Buddhist teachings, assists in correcting the distortion of ignorance by enabling us to perceive things as they are in actuality. This ultimate truth of existence that we are enabled to see is known as the *Dhamma*

(Gunaratana, 1996). The wisdom needed to uproot ignorance can be cultivated through the investigation and development of particular mental factors that systematically come together in the Buddha's Noble Eightfold Path, *ariya atthangika magga* (Chiesa, 2013). The path consists of the following eight factors: Right view (the view one has of what is real, important, valuable and useful); Right intention (how intention is used to initiate and sustain action in skillful ways); Right speech (the nature of speech that can be either harmful or beneficial); Right action (the quality of action as it relates to ethical principles); Right livelihood (one's means of sustaining oneself in the world); Right effort (the degree and quality of effort employed to bring about change); Right mindfulness; and Right concentration (concentration as a focusing and supporting factor to mindfulness) (Siegel, Germer & Olendzki, 2009).

The Buddhist understanding of mindfulness, known as right mindfulness and *sati* in Pali, brings the field of experience into focus, making it accessible to insight or wisdom. It is mindfulness which provides the capacity to allow our awareness to rest at the level of bare attention, which is a detached observation of what is happening within us and around us in the present moment (Bodhi, 1984; Gunaratana, 1996). This allows the mind direct access to the phenomenon as it is in itself, without the cluttering of conceptual elaborations. Consciousness of the present takes place for only brief glimpses within ordinary consciousness, whereas within mindfulness, there is only a sustained contemplation of experience in its bare immediacy, carefully, precisely and persistently. The mind remains anchored in the present moment without springing off the latent defilements and entering into judgements about or reactions to the present moment, nor into memories about the past or ideas about the future, it simply remains in the present by noticing each raw phenomenon as it rises, remains and passes away. Gunaratana (1996) described it as follows, "Mindfulness is the observance of the basic nature of each passing phenomenon. It is watching the thing arising and passing away. It is seeing how that thing makes us feel and how we react to it. It is observing how it affects others. In Mindfulness, one is an unbiased observer whose sole job is to keep track of the constantly passing show of the universe within" (p. 22). By residing in mindfulness, the upper level defilements of *dukkha* do not gain strength through the automatic use and addition to them that occurs during the ordinary state of consciousness.

Simultaneously, the root defilement, ignorance, is gradually disintegrated the more the state of mindfulness is resided in as this state of consciousness is ignorance's direct antithesis. Furthermore, mindfulness has been recognized as developing the memory. A strong memory enhances the ability to remember past experience which can enhance awareness and offer a sense of purpose while developing the ethical aspects of the eightfold path (Chiesa, 2013).

While this summary has not been exhaustive, the intention has been to establish an understanding of the Buddhist conception of mindfulness, of what it is, what it facilitates, what it works alongside, and what it works towards. This lays the historic foundation for mindfulness.

Mindfulness and Modern Psychology

While mindfulness was secularized by Kabat-Zinn (1990), it is nevertheless based on the psycho-spiritual beliefs of Buddhism. There are significant portions of the Buddhist teachings which modern psychological teachings of mindfulness disregard. Firstly, the development of mindfulness within Buddhism is an inherently ethical development. The word “right” in the translation of mindfulness from *sati* significantly underscores that the practice of mindfulness requires an ethical pre-judgement of what is considered both wholesome and unwholesome (Chiesa, 2012). In other words, according to classical perspectives on mindfulness, a degree of ethical judgement is crucial to the proper development of this state of consciousness (Dhammika, 1990, as cited by Chiesa, 2012). This ethical basis of mindfulness is carried out by a “guarding” of oneself in order to be of service to others and, secondly, of “guarding” others by the practice of patience, harmlessness, loving kindness, and compassion (Gilpin, 2009, as cited by Chiesa, 2012). Secondly, while psychological methods of mindfulness aim to bring relief to difficult psychological conditions, the proposed outcome of a dedicated Buddhist practice is radically different: the complete cessation of suffering. In modern terms this can be pictured as a life without a trace of the psychological symptoms found in the DSM-5 (Siegel, Germer & Olendzki, 2009).

While significant differences exist between Buddhist views of mindfulness and modern psychological adaptations, there is a consensus between prominent authors that mindfulness is a state

of consciousness which makes use of the common cognitive functions – awareness and attention – in a particular way. The qualities of attention and awareness involved in mindfulness can vary considerably both intraindividually and interindividually (at different points in time), from heightened states of clarity and sensitivity, to low levels, as is seen in habitual, automatic and distracted thought or action (Brown & Ryan, 2003; Wallace & Shapiro, 1996). The extent to which awareness and attention is placed on present-moment phenomena also differs widely both within and between individuals. The two different schools of thought agree that, regardless of where an individual's novice mindfulness levels begin, the cultivation and development of mindfulness is facilitated by a methodical mental training, usually referred to as meditation (Chiesa & Malinowski, 2011; Davidson et al., 2003)

What is meditation?

The traditional definition of meditation within Western culture involves sustained consideration or thought upon a particular subject. The word originated from the Indo-European root *med*, primarily meaning *to measure* (Olendzki, 2009). Meditation, in this sense, always consists of “ordered conceptual contemplation, involving the systematic and disciplined use of language, symbol, and concept (Olendzki, 2009, p. 36). However, the word meditation has begun to denote a practice which differs significantly from the original understanding within Western society.

As the connection between Western society and Eastern culture began to develop the interest in Buddhism grew, leading to an alteration in the Western understanding of meditation. Contemporary society (for the *West* is no longer technically correct, since this region and culture has been increasingly globalizing) has been exploring the Buddhist conception of meditation both experientially and academically at an exponential rate (Kabat-Zinn, 2013). In the classical languages of Buddhism, the most common word for meditation is *samadhi*. The etymology of this term suggests gathering (*sam-*) the mind and placing it upon an object (Olendzki, 2009). While there are obvious similarities, the theoretical difference between the Buddhist and traditional Western understanding of meditation is subtle, yet critical. As opposed to choosing a subject of inquiry and allowing the mind to think about it,

meditation within Buddhism is the practice of placing awareness and attention on to (usually) one phenomenon, which is typically made up of raw sensory data. Meditation is characterized by the intention and action of returning awareness and attention to that experience/object, rather than allowing the mind to think about it (Kabat-Zinn, 2013). Meditation provides the scaffolding for the state or skill of mindfulness to be developed (Kabat-Zinn, 2013). This conception of meditation has been fully embraced by modern psychologists.

Meditation is based on two fundamental behaviours of the mind: concentration (also known as Focused Attention [Shapiro, 1992]) and awareness (also referred to as: Mindfulness meditation, Receptive attention or awareness and Open monitoring). Awareness is believed to be the essential form of mindfulness (Mikulas, 2015). Thus, the meditation techniques which predominantly utilize awareness will be referred to as Mindfulness. Mindfulness is both a process (intentional meditation technique) and an outcome (mindful awareness). Shapiro & Carlson (2009) distinguish between the two as follows: “(a) mindful awareness: an abiding presence or awareness, a deep knowing that manifests as freedom of mind (e.g., freedom from reflexive conditioning and delusion) and (b) mindful practice: the systematic practice of intentionally attending in an open, caring, and discerning way, which involves both knowing and shaping the mind” (p. 4). Mindfulness as a meditation method will be designated with a capital M, emphasizing intentionality whereas mindfulness as an awareness will have all letters in lower-case.

Concentration and Mindfulness, the two forms of meditation which all techniques consist of, are distinctively different in how they are cultivated, their psychological effects and their neural correlates (Mikulas, 2015). This distinction is dependent on how the attentional processes are used (Valentine & Sweet, 1999). However, both forms are understood to enhance levels of mindfulness (Chiesa & Malinowski, 2011). This is likely due to the fact that both general styles of meditation intentionally incorporate levels of the other, while specific individual techniques vary the degree of the mix (Chiesa, 2013). It has therefore been proposed that concentrative and awareness techniques are on a continuum, although they never really sit solely alone, completely unmeshed from the other (Chiesa, 2013). In

short, concentration can be viewed as the learned control of the focus of one's attention whereas (mindful) awareness entails maximizing the breadth and clarity of awareness (Dunn, Hartigan, & Mikulas, 1999; Mikulas, 2015). Meditation techniques, whether predominantly concentrative or Mindfulness based, are formally practiced by intentionally using the attentional processes in the specified way for a particular amount of time.

Concentration Meditation

The concentration form of meditation consists of sustaining attention moment by moment on a chosen object. Rather than solely referring to a material object, *object* within the meditation literature can refer to any experienced phenomena, such as sensations (Dunn, Hartigan & Mikulas, 1999; Mikulas, 2015; Olendzki, 2009). Objects commonly used in this form of training include: counting, a short word or saying repeated in the mind (known as a mantra), an imaginal visualization or the flame of a candle. Although the breath is the most commonly used. To sustain attention on the breath, a subset of localized sensations caused by the respiration are selected and focused on. The aim of concentrative meditation is to continuously return focus (or concentrate) on these sensations without being distracted by and attention moving to some internal or external phenomena other than that selected as the object of the meditation. Phenomena which are commonly experienced as distractions in meditation are the phenomena of thoughts, emotions, different internal sensations such as pain and fatigue, and external experiences, such as sounds, sights, smells, or sensations caused in the body by the environment, e.g. temperature. Distraction generally occurs frequently, particularly in the beginning stages of practicing concentrative meditation. Once the drifting of attention is realized the typical instruction of the concentrative technique requests for the meditator to voluntarily return their attention to the original object (Chiesa, 2013; Lutz, Slagter, Dunne & Davidson, 2008). For example, while intending to focus on localized sensations of the stomach rising and falling during respiration, one may notice that the focus has shifted to pain in the knee. The meditator is then to release this distraction from their attention,

and return it to the intended object (Lutz, Slagter, Dunne & Davidson, 2008). This process is repeated again and again until the culmination of that particular session of meditation practice (Olendzki, 2009).

Concentrative meditation develops the ability to sustain attention on an intended object, monitoring the focus of attention and detecting distraction, disengaging attention from the source of distraction, and (re)directing and engaging attention on the intended object. These skills have been associated with the following dissociable cognitive systems: conflict monitoring, selective attention and sustaining attention (Corbetta & Shulman, 2002; Posner & Rothbart, 2007; Weissman, Roberts, Visscher & Woldorff, 2006, as cited by Lutz, Slagter Dunne & Davidson, 2008). Progress in this form of meditation is partly determined by how often the skills utilised to maintain focus on the intended object are required. The novice meditator typically experiences more distraction requiring more frequent use of these skills. As meditation practice continues these skills are strengthened to the point where the advanced practitioner has an especially acute ability to notice when the mind has wandered and the regulative skills are used in increasingly diminishing amounts (Lutz, Slagter Dunne & Davidson, 2008; Mikulas, 2015). Olendzki (2009) recognises that if this process of focusing and re-focusing the mind on a single object is allowed to mature it eventually reaches a stage called absorption or single-pointedness. This is a state where the mind is so precisely attending to the chosen object that it is no longer aware of other phenomena that might present themselves to our sensory informants. The discipline and focus concentrative styles brings to the mind are indispensable for the development of mindfulness. However, since single-pointedness is the ultimate stage of this technique, Mindfulness advocates consider this style of limited use, yet useful for the beginning stages of Mindfulness development (Chiesa, 2013; Gunaratana, 1996; Lutz, Slagter, Dunne & Davidson, 2008; Malinowski, 2013; Olendzki, 2009).

Both historically and in contemporary psychological practices concentrative meditation is usually involved in the opening stages of Mindfulness. The relationship between concentration and Mindfulness is definite, delicate, and complex, where an improvement in one often improves the other (Mikulas, 2015). As previously mentioned concentrative and Mindful styles are entwined with one

another to varying degrees, dependent on the specific technique. While concentration consists of forcing attention to remain on one object, mindfulness is considered to be responsible for the monitoring that notices when attention has become distracted from the object (Bodhi 1984; Gunaratana, 1996). The employment of a concentrative technique enables the practitioner to calm their mental activity and develop attentional stability, clarity, and awareness of their current state. This guides the practitioner away from becoming distracted by and actively involved in conceptual notions and personal narratives (Lutz et al., 2008). This allows the mind to be anchored in the present moment, and ready to step into practicing Mindfulness meditation (Chiesa, 2013; Malinowski, 2013). As use of the concentrative technique advances, the well-developed monitoring skill becomes the main point of transition into Mindfulness practice (Lutz, Slagter, Dunne & Davidson, 2008). The transition between the two forms requires the gradual reduction of focus on the explicit object while the monitoring faculty is increasingly emphasized (Lutz, Slagter, Dunne & Davidson, 2008; Malinowski, 2013).

Mindfulness Meditation

The enhancement of the mindful awareness (monitoring) continues until no explicit focus is maintained in the meditation, leaving us with what is considered a more advanced level of meditation practice: a Mindfulness based practice (Malinowski, 2013). What distinguishes Mindfulness as a practice from mindfulness as a naturally arising state of consciousness is the intentionality of practicing, of entering into, and returning to this state of consciousness for an intended amount of time. Typically, Mindfulness is practiced while sitting, although it is also commonly exercised while the body is engaged in slow activities, such as walking or gentle forms of yoga. The essence of this practice is simply noticing all phenomena that arise within consciousness while minimizing the occurrence of getting lost in related thoughts, emotions, and sensations (Cahn & Polich, 2006; Mikulas, 2015). It involves the cultivation and development of an open monitoring of the whole sensory and cognitive/affective fields and includes what has been called a meta-awareness of the contents of thought (Cahn & Polich 2006; Lutz, Slagter, Dunne & Davidson, 2008). Therefore, during Mindfulness practice, the individual who

becomes aware that they are thinking simply returns to being aware of the thoughts occurring, allowing them to be just another feature within the landscape of their awareness, rather than the primary activity they are engaged in. There is less a sense of controlling what the awareness is resting upon and more care given to how awareness is manifesting. Olendzki (2009) has offered the following metaphor, “like a floodlight rather than a spotlight, mindfulness illuminates a more fluid phenomenological field of ever-changing experience rather than isolating a particular object for intensive scrutiny” (p. 42). He notes that this alternative mode of observation is crucial because Mindfulness practice is more about investigating a process – the unfolding process of experience in the present moment – than about examining an object (Olendzki, 2009). Mindfulness's emphasis on open awareness to all sensations, thoughts and emotions that arise contrasts with concentrative modes of meditation and differs from Husserl's phenomenological attitude. Concentrative meditation, by contrast, places a strong distinction between the selection and de-selection of phenomena entering awareness resulting in the suppression of cognitions and affects as soon as they arise. Husserl's phenomenological attitude differs by seeming to not recognize cognitions or emotions as raw, primary content. However, Mindfulness, concentrative meditation and Husserl's perspective share the prominent similarity of requiring awareness to not become actively involved in any part of the thought or affect process.

Mindfulness Practice, Mindfulness Levels and Psychological Functioning

The effects of Mindfulness practice appear to be dose related. If a small amount of Mindfulness is practised every day, a small level of mindfulness develops, which in turn, leads to small levels of improvement in psychological functioning (Carmody & Baer, 2008). If the amount of Mindfulness practised each day is increased, the effects are more dramatic (Siegel, Germer & Olendzki, 2009). This expectation is well established within Buddhist meditation trainings (Carmody & Baer, 2008) and has long been evident to practitioners of meditation (Siegel, Germer & Olendzki, 2009). Empirical evidence for the association between Mindfulness practice, mindfulness levels and improvements in

psychological functioning is building (Carmody & Baer, 2008; Lazar et al., 2005; Ramel, Goldin, Carmona & McQuaid, 2004; Toneatto & Nguyen, 2007).

Carmody & Baer (2008) investigated this claim with a large participant pool. Participants enrolled in a Mindfulness Based Stress Reduction (MBSR) programme completed measures on: mindfulness (Five Facet Mindfulness Questionnaire, Baer et al., 2006); psychological symptoms (Brief Symptoms Inventory, Derogatis & Spencer, 1993); medical symptoms (Medical Symptom Checklist, Kabat-Zinn, 1982; as cited by: Carmody & Baer, 2008); perceived stress (Perceived Stress Scales, Cohen et al., 1983; Cohen & Williamson 1988; as cited by: Carmody & Baer, 2008), and well-being (Scales of Psychological Well-Being, Ryff & Keyes, 1995), pre- and post-MBSR. Participants were also required to monitor their home practice time throughout the intervention. Results showed increases in mindfulness (with effect sizes in the moderate to large range) and well-being, as well as decreases in stress and symptoms, from pre- to post- MBSR. Time spent formally meditating was significantly correlated to improvement in mindfulness levels, and several measures of symptoms and well-being.

To examine whether increases in mindfulness mediated the relationship between reported minutes spent in practice and improved psychological functioning Carmody & Baer (2008) used three mediation analyses based on linear regression. Meditation practice time was a significant predictor of the increase in mindfulness ($R = .42$, $F = 21.95$, $p < .001$), and of the decrease in psychological symptoms ($R = .30$, $F = 11.39$, $p < .01$). When meditation practice time and increase in mindfulness were both entered as predictors for the decrease in psychological symptoms the regression coefficient for practice time dropped from .30 to .10 (ns). This drop in the regression coefficient is significant ($t = 3.57$, $p < .01$). This result supports the idea that the relationship between formal meditation practice time and psychological symptoms is completely mediated by increases in mindfulness levels.

The authors found a similar pattern when perceived stress was the dependent variable in the mediation analysis (Carmody & Baer, 2008). Meditation practice time was a significant predictor of the increase in mindfulness ($R = .42$, $F = 46.50$, $p < .001$) and the reduction in perceived stress ($R = .26$, $F = 8.30$, $p < .01$). Increase in mindfulness was also a significant predictor of the reduction in perceived

stress ($R = .44$, $F = 34.74$, $p < .001$). When meditation practice time and increase in mindfulness were both entered as predictors for the reduction in perceived stress the regression coefficient for practice time dropped significantly to .12 (ns) ($t = 2.77$, $p < .01$). This result suggests that the relationship between meditation practice time and perceived stress is also completely mediated by the development of mindfulness.

In regards to psychological well-being, the authors only found partial mediation for improvements in this area (Carmody & Baer, 2008). Meditation practice time was a significant predictor of increase in mindfulness ($R = .42$, $F = 21.95$, $p < .001$), and of well-being ($R = .42$, $F = 24.14$, $p < .001$). When meditation practice time and increase in mindfulness were both entered as predictors of well-being, however, the relationship between practice time and well-being remained significant. Although, the drop in the regressions coefficient from .42 to .25 was significant ($t = 3.87$, $p < .01$). Thus, while increases in mindfulness are important in accounting for increases in well-being, variables not included in the authors analysis may also account for improvements in well-being (Carmody & Baer, 2008).

The authors ruled out a plausible alternative explanation of their findings: that more mindful people are more likely to practice Mindfulness (Carmody & Baer, 2008). The results showed non-significant relationships between baseline levels of mindfulness and the extent of meditation practice during the intervention (Carmody & Baer, 2008). The findings of Carmody & Baer (2008) provide further support for the central tenet of mindfulness teachings: that the regular practice of Mindfulness will develop and cultivate mindfulness, which in turn will lead to improved psychological functioning, such as psychological and physical symptom reduction, reduced stress and enhanced well-being

The success of mindfulness as a psychological intervention has seen the use of it integrated into psychology to the point where it is now a part a third wave of behavioural therapies (Claessens, 2010). In a recent survey of psychotherapists in the United States (Simon, 2007; as cited by: Siegel, Germer & Olenzki, 2009), the percentage of therapists who said they do “mindfulness therapy” at least some of the time, was 41.4%. Furthermore, meditation is now one of the most widely researched psychotherapeutic methods (Walsh and Shapiro, 2006). As Siegel, Germer and Olendzki (2009)

recognize, we are now in the midst of a fertile convergence of modern scientific psychology with the ancient Buddhist psychological tradition of mindfulness.

Difficulties in Defining Mindfulness

There are currently conflicting opinions whether mindfulness (and Mindfulness) has inherent attitudinal pillars. Acceptance is the attitude most widely debated. Jon Kabat-Zinn is the foremost pioneer in the extraction of mindfulness from Buddhist approaches and the translation of it into a secular psychological framework (Kabat-Zinn, Lipworth & Burney, 1985; Kabat-Zinn 1992; Kabat-Zinn, 2011). He defines mindfulness as “the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145). Kabat-Zinn’s Mindfulness Based Stress Reduction programme (MBSR) consists of seven attitudinal pillars: acceptance, non-judging, patience, a beginners mind, trust, non-striving, and letting go (Kabat-Zinn, 2013). He emphasizes that these attitudes are to be cultivated consciously when one is practising Mindfulness (Kabat-Zinn, 2003). In 2004, Bishop and colleagues offered an influential consensus paper with an operational definition of mindfulness necessitating the explicit presence of acceptance. Mindfulness was defined as “self-regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present moment” and “adopting a particular orientation toward one's experience that is characterized by curiosity, openness, and acceptance” (Bishop et al., 2004, p. 32). Bishop and colleagues (2004) definition of Mindfulness has been abbreviated to (a) attention and awareness and (b) acceptance (Brown & Ryan, 2004). Kabat-Zinn (2003) and Bishop et al. (2004) are amongst the prominent authors opting for an attitudinal component to mindfulness which includes acceptance, atop of the undisputed components, attention and awareness.

Brown & Ryan (2004) openly contest Bishop et al.'s (2004) addition of acceptance as a separate factor within the definition of mindfulness. In their paper *Perils and promise in defining and measuring mindfulness: Observations from experience* Brown & Ryan (2004) detail their own journey with considering acceptance as a primary component of mindfulness. Having initially

accepted acceptance within their theoretical position they hypothesized that attention/awareness are related, as Bishop et al.'s (2004) definition suggests. Their hypothesis was tested via a self-report scale comprising of two factors: *Presence* and *Acceptance*. Presence contained items assessing present-centered attention and awareness. Whereas acceptance included items such as “When unpleasant thoughts arise, I don’t feel I have to put my attention somewhere else” and “I don’t like feelings like fear or anger, so I don’t allow myself to experience them” (reverse scored) (p. 244). These two factors were correlated (in the .20 to .35 range across different samples). Confirmatory factor analyses found that a second-order factor model, where the two factors lay enveloped by an overarching *mindfulness* factor, provided a satisfactory fit. However, their convergent, discriminant, and criterion validity research showed, across several large samples, that the acceptance factor provided no explanatory advantage over that shown by the presence factor alone (Brown & Ryan, 2001, as cited by: Brown & Ryan, 2004).

Brown & Ryan (2004) discuss that the redundancy of the acceptance factor they found in their preliminary work (Brown & Ryan, 2001, as cited by: Brown & Ryan, 2004) may be because mindfulness subsumes an acceptance of what occurs. This perspective is supported by numerous authors within the modern mindfulness literature (Brown & Ryan, 2004; Brown, Ryan & Creswell, 2007; Grossman, Niemann, Schmidt & Walach, 2004) and is parallel to the Buddhist perspective (Siegal, Germer & Olendzki, 2009; Gunaratana, 1996). The idea is that embedded within the capacity to sustain attention to and awareness of what is occurring is an openness and acceptance of it. Presence to the moment means receiving each moment as it comes through awareness. When someone does not accept what is occurring in the moment, a natural reaction is to limit awareness and redirect attention. This becomes an avoidance or escapement from the phenomena in various ways, such as: mentally, by getting lost in a stream of unrelated thought or moving into a reactive phase of judgement or attempts to work out how to change the phenomena; behaviourally, such as taking abrupt action in reaction to the phenomena; within the physical body, such as the tensing of muscles; or by some other similar means (Brown & Ryan, 2004). To turn away from any phenomena that is received through

awareness is to become inattentive and unaware – that is, to cease to be present. As Tolle (1999) writes “fullest attention to whatever the moment presents ... implies that you also completely accept what is, because you cannot give your full attention to something and at the same time resist it” (p. 56). Buddhist scholar Gunaratana (1996) notes “it is psychologically impossible for us to objectively observe what is going on within us if we do not at the same time accept the occurrence [of what is occurring]” (p. 19). Thus, mindfulness subsuming acceptance has the support of traditional Buddhist perspective, as well as empirical research.

Difficulties in Measuring Mindfulness

Over the past decade and a half several psychometric questionnaires have been developed in attempts to measure mindfulness. The variation in measures available both reflects and contributes to the current discrepancy within the definition of mindfulness. A predominant debate in this area is whether mindfulness is more accurately described as a state or trait-like phenomenon.

When mindfulness is considered a trait, questionnaires are designed to assess the extent to which individuals tend towards awareness and sustained attention to what is presently occurring, in the context of their everyday lives (Brown & Ryan, 2003). The questionnaires that have emerged from the mindfulness literature are predominantly trait-based. The following are those which are most widely used: The Freiburg Mindfulness Inventory (FMI; Buchheld, Grossman, & Walach, 2001) is a 30-item instrument designed to assess nonjudgmental present moment observation and openness to negative experience in experienced meditators. The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item measure assessing the general tendency to be *attentive to and aware of* present-moment experiences in everyday life. The Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith & Allen 2004), is based largely on the Dialectical Behaviour Therapy (DBT; Linehan, 1987) conceptualization of mindfulness skills and includes 39 items measuring four facets of mindfulness: observing, describing, acting with awareness, and nonjudgmental acceptance. The Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman, Hayes, Kumar,

Greeson, & Laurenceau, 2007) is a 12-item measure of attention, present focus, awareness, and acceptance of thoughts and feelings in general daily experience. The Southampton Mindfulness Questionnaire (SMQ; Chadwick, Hember, Mead, Lilley, & Dagnan, 2005) is a 16-item inventory assessing the degree to which individuals mindfully respond to distressing thoughts and images. Although the SMQ is designed to capture four aspects of mindfulness (mindful observation, non-aversion, nonjudgment, and letting go), the authors recommend use of a single total score. Finally, the Philadelphia Mindfulness Scale (PHMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2007) is a 20-item measure which includes two factors that are scored separately: awareness and acceptance.

While mindfulness researchers typically regard (and measure) mindfulness as a trait, it is also considered a state by some. Through this lens mindfulness is understood as a mode, or state-like quality, that is maintained only when attention to experience is intentionally cultivated with an open, nonjudgmental orientation to experience, as Lau et al. (2006) suggest. The authors based their view on the theory of Bishop et al. (2004), which has been previously discussed. Lau et al.'s (2006) Toronto Mindfulness Scales (TMS) were constructed to assess the attainment of a mindful *state* during an immediately preceding meditation session. The use of this measure requires participants to practice a meditation exercise for approximately 15 minutes before rating the extent to which they were aware and accepting of their experiences during the exercise. The instrument has two factors: A curiosity factor, which reflects interest and curiosity about inner experiences; and a decentering factor, which emphasizes awareness of experiences without identifying with them or being carried away by them.

The State-MAAS is another measure within the psychological literature constructed from a state-like perspective of mindfulness. It is also the second mindfulness measure developed by Brown & Ryan (2003). As previously discussed, these authors disagree with Bishop and colleagues by opting to understand mindfulness as lacking an acceptance component. Having created a trait-based mindfulness measurement, the differing of opinions between these leading authors continues, with Brown & Ryan considering mindfulness both a state and trait compared to Bishop et al.'s view of mindfulness as simply a state-like phenomenon. Brown & Ryan's State-MAAS was implemented

through experience sampling by participants who carried pagers for several weeks. When paged at quasi-random intervals each day, participants immediately responded to a subset of MAAS items asking about the extent to which they were attending to their activity of the moment or were behaving automatically.

Evidently these leading mindfulness measures vary in their theoretical approach to mindfulness. Notably, only Brown & Ryan (2003) consider mindfulness as attention and awareness to the present moment within both the state and trait distinctions. All other measures include a variety of additional attitudinal components, with acceptance or a similar quality having a high presence. Bishop et al. (2004) hold an unusual stance, considering mindfulness as solely a state-like quality. The majority of mindfulness researchers, however, consider mindfulness to exist as both a state and a trait. To reiterate, mindfulness is considered a state when attention and awareness to present-moment experience is *intentionally* being cultivated (Chiesa, 2013) and trait mindfulness describes the extent to which people focus on the present as part of their baseline attentional patterns (Brown & Ryan, 2003). They are closely related constructs, but definitively different, and the theoretical and operational distinction between the two is necessary and important (Thompson & Waltz, 2007).State mindfulness has been shown to be significantly correlated with baseline levels of trait mindfulness (Brown & Ryan, 2003). This supports the widely held perspective that intentionally cultivating mindfulness alters people's long-term, natural capacity to live in a more mindful way. Meditation practice has shown to produce relatively short-term changes in state as well as long-term changes in traits (Cahn & Polich, 2006; Shapiro & Walsh, 1984). Trait-like changes occur gradually over time as a consequence of sustained meditation practice and persist throughout the day. The changes to trait levels are thought to result from stable, long-term transformations in brain activity and structure (Treadway & Lazar, 2009).

There is currently rigorous debate within the mindfulness literature and no settled consensus over what mindfulness is, how to define it and how to measure it. An overview of these different perspectives has been detailed. It is important to draw a line in the sand and clarify how this paper

will approach the concept of mindfulness and why. This author finds the most simple definition, of mindfulness as attention and awareness to the present moment, the most compelling. A number of reasons have led to this conclusion. Firstly, it is more aligned with the Buddhist perspective of mindfulness, and Buddhism has a vast and thorough history of investigating this phenomenon. Secondly, the theoretical argument that mindfulness does not include an attitudinal component is supported by the capacity of mindfulness to be aware of any attitude, suggesting it is a different operation. Thirdly, while others add various additional components, all measures in the literature contain attention and awareness to the present moment making these two components the unwavering common thread between all proposed definitions. Fourthly, Brown & Ryan's (2001, as cited by: 2003) research (which has been discussed in detail) provides supportive evidence. The dispute between mindfulness as a state- or trait-based phenomena is important to discuss. Despite Bishop et al.'s (2004) contrary perspective, there is clear support by the majority of leading measurement developers, as well as theoretical and evidential support that both state and trait mindfulness exist. Thus, this paper will proceed with recognizing mindfulness as both a state and trait.

As previously mentioned, Mindfulness will be used to denote mindfulness meditation, which is the *practice* of intentionally bringing attention and awareness to present-moment stimuli. It is the practice that is the framework for state-mindfulness to be elicited, i.e. the *act* of sitting on a cushion for x amount of minutes with the intention of being mindful. This will be distinguished from the state of consciousness that is being utilized within the Mindfulness practice, which will be referred to as state-mindfulness. Mindfulness, as an inherent capacity within the human organism which can gradually become weaker or stronger, also known as trait-mindfulness, will be simply referred to as mindfulness. In accord with the view that mindfulness is attention and awareness to both internal and external stimuli the MAAS (Brown & Ryan, 2003) has been selected to measure trait mindfulness.

The MAAS measures trait mindfulness by examining the frequency of mindful moments in day-to-day life with the use of general and situation specific statements across 15-items. Examples of these questions range from: I could be experiencing some emotion and not be conscious of it until

sometime later; I tend to not notice feelings of physical tension or discomfort until they really grab my attention; It seems I am “running on automatic”, without much awareness of what I’m doing. Based on a mean of all items, MAAS scores can range from 1 to 6 (where 1 = almost always, 2 = very frequently, 3 = somewhat frequently, 4 = somewhat infrequently, 5 = very infrequently, 6 = almost never. Higher scores are thus indicative of higher levels of mindfulness. The total score for the questionnaire is calculated by the total of individual answers divided by the total number of questions (15) (see Appendix E). The trait MAAS has shown excellent psychometric properties across numerous studies since 2003. Factor analyses with undergraduate, community and national-American sampled adult and adult cancer populations have confirmed a single factor scale structure (Brown & Ryan, 2003; Carlson & Brown, 2005). Internal consistency levels (Cronbach’s alpha) generally range from .80 to .90 (Carlson & Brown, 2005). The MAAS has demonstrated high test-retest reliability, discriminant and convergent validity, known-groups validity, and criterion validity. Correlational, quasi-experimental, and experimental studies have shown that the trait MAAS taps a unique quality of consciousness that is related to, and predictive of, a variety of emotion regulation, behaviour regulation, interpersonal, and well-being phenomena (Brown, 2008).

The Mechanisms of Mindfulness

While this research is still in its infancy, mindfulness has been shown to be associated with a reduction of the default mode network, increased attentional skills, navigating oneself away from the stress response and into the relaxation response, as well as an increased capacity for emotional regulation. This section will also explore the notion of 'self' from the Buddhist perspective, and the impact mindfulness is proposed to have on this usually unquestioned aspect of the human experience. The research presented is still somewhat speculative. Any process or mechanism identified at this point in the research of mindfulness may be better thought of as correlates, until a body of research emerges that indisputably identifies them as true mediators of the relationship between mindfulness and physiological and behavioural change (Chambers, Gullone & Allen, 2009).

Mind-Wandering, the Default Mode Network (DMN) and Mindfulness

The awake human-being is constantly presented with large volumes of data. Attention generally operates by choosing one piece of this data and moving it to the working memory (Knudson, 2007). Attention's decision of what pieces of data to choose is dependent on the data's level of salience: the higher the salience, the more likely it will be chosen. The three types of data with the greatest salience are: threat, pleasure and novelty. Threat has been evolutionarily preserved as the primary focus for attention, due to its indisputable survival value (Sood & Jones, 2013). It served as a protection for the individual and the species during our more primitive and ruthless existence, where it primarily protected the human being against physical danger (Bood, 2007). However, the world has changed drastically since this function made its evolutionary appearance.

Sood & Jones (2013) recognize that the average urban or suburban dweller of today, living in a low-crime and war-free neighbourhood, experiences significantly lower physical threats than pre-historic humans. These physical threats have been largely replaced by psychological ones: worries and emotional hurts (Sood & Jones, 2013). Our innate threat focus, coupled with the psychological threats we hold inside our minds, means attention gets rerouted, spending more time inside the mind, than attending to the present moment (Verstraeten, Bijttebier, Vasey & Raes, 2011). The dramatic increase in the choices around us as well as our phenomenal capacity to imagine, only increases attention's focus inward (Sood & Jones, 2013).

The unintentional movement of attention away from the present moment is known as mind-wandering. Mind-wandering is ubiquitous, with 96% of Americans reporting the experience of mind-wandering daily (Christoff, 2012). In the absence of a task that requires deliberative processing, the mind tends to move rapidly from one thought to the next with fluidity and ease (Mason et al., 2007). Even though individual differences have been found in people's stable tendency to create stimulus-independent thought (McGuire, Paulesu, Frackowiak & Frith, 1996), research suggests that the human mind may wander on average 50% of our awake life (Killingsworth & Gilbert, 2010). Given the ubiquitous nature of this phenomena, mind-wandering has been suggested as a psychological baseline

which people leave when attention is required elsewhere and to which they return once tasks no longer need conscious supervision (Mason et al., 2007). Even though mind wandering may contribute to low state vigilance (Braboszcz & Delorme, 2011), studies show that mind wandering decreases happiness (Smallwood & O'Connor, 2011; Killingsworth & Gilbert, 2010). With a participant pool of 2250, Killingsworth & Gilbert's (2010) time-lag analyses strongly suggest that mind-wandering is generally the cause, and not merely the consequence, of unhappiness. The authors concluded their research by stating “a human mind is a wandering mind, and a wandering mind is an unhappy mind. The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost” (Killingsworth & Gilbert, 2010, p. 932). Suggesting that mind-wandering, while it may be considered the psychological baseline, is an unhealthy one.

Mind-wandering is known to correlate with neural activity in a network of brain areas known as the default mode network (DMN) (Mason et al., 2011; Weissman, Roberts, Visscher & Woldorff, 2006). The DMN is associated with self-referential processing, hosting operations such as: the construction of mental models or adaptive stimulations to guide future behaviour; the processing of internal cognition to imagine alternative scenarios; self-referential processing; imagining the future; and, importantly, our ability to imagine our ability to imagine from another person's perspective, known as “theory of mind” (Sood & Jones, 2013; Brewer et al. 2011). It is an interconnected and anatomically defined network that can be separated into three different hubs: the posterior cingulate cortex (PCC) and precuneus; the medial prefrontal cortex (mPFC); and the angular gyrus (Andrews-Hanna, Smallwood & Spreng, 2014). Upon the discovery of the DMN's association with mind-wandering mindfulness researchers have become interested in how maintaining attention on the present moment affects the activity of this brain region.

Mindfulness (and other forms of meditation that cultivate mindfulness) is beginning to demonstrate differences in the DMN that are consistent with decreased mind-wandering (Brewer et al., 2011; Hasenkamp, Wilson-Mendenhall, Duncan & Barsalou 2011; Sood & Jones, 2013). Brewer and colleagues investigated DMN activity in healthy experienced meditators (average of 10,565 meditation

hours over 10-plus years) with matched meditation-naïve controls as they engaged in three different meditation techniques. While Mindfulness was one of the techniques used, the other two- loving-kindness and concentration - have both been shown to enhance mindfulness in practitioners (Neff & Germer, 2013). The authors found the main nodes of the DMN (medial prefrontal and posterior cingulate cortices) to be relatively deactivated in the experienced meditators during all three meditation styles. The meditators also reported experiencing significantly less mind-wandering than their controls. While between-group differences were found, several limitations of this study have been acknowledged by the authors. The sample size is relatively small, with 12 meditators and 13 control participants. This can limit the ability to detect small differences between conditions while increasing the chances of false or inflated positive findings. Concerns over self-reporting by meditators have also been discussed by various mindfulness researchers. Lastly, the authors GLM analyses, which rely on changes from baseline, may have been limited by both experienced meditators tendency to be consistently mindfully aware, whether engaging in formal meditation or not; and by the use of meditation periods which were several minutes in length (Brewer et al., 2011).

Hasenkamp, Wilson-Mendenhall, Duncan & Barsalou (2011) explored differences to the DMN during a concentrative form of meditation (breath focus). Fourteen healthy meditators with an average of 1386 hours experience participated in an elegant design to measure four proposed intervals in a cognitive cycle in the context of meditation: mind-wandering, awareness of mind-wandering, shifting of attention, and sustained attention. The participants meditated for 20 minutes while undergoing functional magnetic resonance imaging (fMRI). They pressed a button whenever they realized their mind had wandered completely away from their breath and had become fully absorbed in a train of thought. The instruction was to then return their focus to their breath. Prior to the experiment participants trained during their regular meditations in the presence of an audio file of scanner noise for acclimatisation over several weeks. The investigators found: The DMN was activated during mind wandering, the salience network was activated when participants became aware of their mind-wandering, and the greater executive network activated during the shifting and sustaining of attention.

Asides from the relatively small sample number, this study is limited by only being able to record mind-wandering from when participants become consciously aware of it. Data for when mind-wandering begins is currently un-measurable. To control for this the authors censored from their analysis all time points that did not fall into one of the defined phases, and only examined a small section of time in which they claimed to be relatively certain that the relevant cognitive events were occurring (Hasenkamp, Wilson-Mendenhall, Duncan & Barsalou, 2011).

Decreased activation of the DMN has also been found during ordinary states of awareness in those who meditate, in comparison with those who do not. Brewer et al (2011) (discussed in detail earlier) found distinct functional connectivity patterns in the DMN that were consistent across resting-state baseline and all meditation conditions. The meditators showed increased connectivity between the PCC and task-positive regions including those involved in conflict monitoring, cognitive control, and working memory (dorsal anterior cingulate cortex [dACC] and the dorsolateral prefrontal cortex [dlPFC]). These findings suggest that meditation practice may transform the resting-state experience into one that resembles a meditative state, and as such, offers a more present-centered default mode.

In summary, mind-wandering's ubiquitous nature has led it to be considered the human mind's psychological baseline. Its activity is known to be associated with the default mode network (DMN). Whilst a new area of research, mindfulness and other forms of meditation that elicit mindfulness are beginning to demonstrate differences in the DMN that are consistent with a reduction in mind-wandering. This has been demonstrated both while people are intentionally engaging in meditation, and when they are not. This suggests that Mindfulness may lead to the creation of a new psychological baseline of present-centered awareness. A baseline, that in diametrical opposition to the default mode of mind-wandering, leads to increases in well-being. This area is of importance to understanding the mechanisms through which Mindfulness practice and trait-mindfulness impact and alter the human mind and experiencing. Given small participant numbers and minimal studies in this area thus far, research must continue before more definitive understandings are drawn.

Attention and Mindfulness

Mindfulness' movement away from the automatic use of the DMN is likely facilitated by the intentional focusing of awareness through attention. Attention is a hypernym which consists of several sub-processes. These sub-processes are assumed to be composed of more elementary processes which are currently unknown. While the literature is presently unclear about precisely which attentional sub-processes are enhanced by Mindfulness it is evident that Mindfulness does impact attention. Indeed, Mindfulness' impact on attention is believed to be the key way this meditation technique produces its effects.

Several neuropsychological frameworks have been suggested to describe the sub-processes of attention. Mirsky (1989, as cited by Cohen, 2014) provided one of the first, which is composed of five elements: Selection; Focus; Execute; Switch; and Sustain. Mirsky derived this framework from factor analyses of neuropsychological test results obtained from a large sample of his clinical practice. Another framework, advanced by Posner & Rothbart (2007), separates attention into three systems: Alerting; Orienting; and Executive Control. These are proposed as three functionally distinct neural networks which are associated with discrete structures and chemical modulators in the brain. A large scale study using the Attention Network Test (ANT; Fan, McCandliss, Sommer, Raz, Posner, 2002), which utilizes these three sub-systems, found that there was very little correlation in efficiency scores among the three networks. Electroencephalographic recordings also found that each of these attention systems is associated with distinct patterns of neural oscillations (Fan, McCandliss, Sommer, Raz, & Posner, 2002). By contrast, Cohen (1993; as cited by: Worden, 2011) proposes four components of attention which are not completely orthogonal or functionally independent, but instead are considered to share common, underlying, elementary sub-processes. This attention framework consists of: sensory selective attention; response intention, selection and control; capacity-focus; and sustained attention. These components were derived from factor analysis of clinical neuropsychological data, where efforts were made to retain the minimum factors necessary to account for maximum variance in the data. Validation of Cohen's framework has shown these principal components to be highly reliable, internally consistent,

and valid with respect to their weighting relative to specific brain disorders and conditions (Worden, 2011).

Plainly, there is a lack of agreement within the attention literature around what the sub-processes of attention are and how they relate to one another. While Cohen's and Posner & Rothbart's four and three item frameworks (respectively) conflict in their ideas of whether the sub-systems share underlying, more elementary processes, they do cover similar areas that constitute the construct of attention.

Cohen's (1993) *sensory selective attention* is the sub-process which entails the general fundamental aspect of attention: its ability to be selective about the use of cognitive resources for further processing of information from the external environment, internal processes or associative representations. Attention constrains incoming information according to the person's capacity at a given time, which keeps the information for processing at a manageable level. Selective attention is operating optimally when the system is flexible and adaptive, where it has the capacity to select and focus on particular stimuli and then shift to others when task conditions change (Worden, 2011). This is similar to Posner & Rothbart's (2007) *orienting system* which is the system responsible for selecting and giving preference to specific sensory information.

Response intention, selection and control (Cohen, 1993), refers to the selection of sensory information through planned and goal-directed behaviour. Attention and responding are directed to seek and filter information that is congruent with goals and will therefore lead to optimized behaviour. The attentional processes involved are related to a wider group of cognitive processes, known as executive functions (Worden, 2011). Several processes associated with response generation underlie executive control: intention, selection, initiation, inhibition, facilitation, and switching. These processes facilitate the control of simple motor responses as well as more complex cognitive and conceptual processes, such as planning, problem solving, decision making, categorization, organisation, and abstraction. For the response intention, selection and control sub-process of attention to work optimally depends on the executive control system's ability to act with intention, to initiate responding, inhibit responding based on new information, and to efficiently switch from one response option to another in accordance with

changing environmental demands (Worden). This is similar to *executive attention* (Posner & Rothbart, 2007) which is the system involved in detecting and responding to situations, especially when there is a stimulus-response conflict, i.e. when two or more stimuli or two or more aspects of the same stimulus are associated with different behavioural responses.

Capacity-focus (Cohen, 1993) refers to attention's capacity to focus both in intensity and by extent to where it is allocated. Attentional capacity is influenced by both structural and energetic factors. Its limitations constrain attention's capacity to focus. Energetic capacity limitations tend to be state dependent, correlated with changing energetic conditions of the brain, including motivation and the incentives to maintain attending (Worden, 2011). This is similar to Posner & Rothbart's (2007) *alerting system* which is responsible for helping the organism reach and maintain an alert state, a state that is characterized by a readiness to perceive and process incoming stimuli.

Finally, Cohen's (1993) *sustained attention* sub-process refers to the processes that allow attentional performance to be maintained over time. Vigilance comes under this sub-process. Vigilance is sustained attention which is directed towards specific targets that occur at variable and infrequent intervals. Both vigilance and sustained attention are influenced by motivational level, boredom, and fatigue (Worden, 2011).

While attention is considered one of the key processes that underpins Mindfulness' impact (Jensen, Vangkilde, Frokjaer, Hasselbalch, 2010), the attentional processes that are likely utilized in this process have been debated. Bishop and colleagues (2004) have proposed a conceptualization of how they believe attention regulation is involved in Mindfulness practice. Four steps of attention regulation have been proposed: sustained attention to maintain awareness of present-moment experience; attention switching to bring attention back to the current moment when it has wandered; inhibition of elaborative processing to limit ruminating or dwelling on feelings or thoughts beyond the present moment; and non-directed attention to enhance awareness of the present moment, unhindered by assumptions and expectations. Mapping this onto Cohen's (1993) (and Posner & Rothbart's [2007]) framework, Bishop et al.'s framework indicates an expectation of the following sub-processes to be activated: sustained

attention, and attention switching, while inhibition of elaborative processing seems to fall within the areas of sustained attention and response intention, selection and control (or Posner & Rothbart's equivalent: executive attention). Lutz, Slagter, Dunne & Davidson (2008), however, emphasise that Mindfulness meditation involves no explicit attentional focus, thus it is proposed to not rely on regions involved in sustaining or engaging attention on a particular object. Instead, brain regions involved in monitoring, vigilance and disengaging attention from stimuli that distract attention from current momentary experience are considered to be involved. This prediction maps on to Cohen's sustained attention, and sensory selective attention (which corresponds with Posner & Rothbart's orienting system).

Mindfulness has been shown to impact selective attention, (orienting; Posner & Rothbart, 2007) (Pagnoni & Cekic, 2007; Napoli, Krech & Holley, 2005; van den Hurk, Gionni, Gielen, Speckens & Barendregt (2009). Pagnoni & Cekic have shown that Mindfulness may counter age-related decline in the process of attention. This was demonstrated with experienced Zen meditators with more than three years' experience. Zen meditation involves: "a mental attitude of openness to one's own mental processes while recognizing the occurrences of episodes of mind-wandering and distraction" (Pagnoni & Cekic, p. 1263). Thirteen meditators who practiced daily were compared with 13 matched controls. Selective attention was measured via a computerized task of rapid visual information processing (RVIP; Sahakian & Owen, 1992) where participants were required to continuously monitor a stream of fast occurring digits for three specific target sequences. Performance was assessed with reaction times (RT) and A, a nonparametric measure from signal detection theory, which rates the ability to detect targets on a scale from 0 to 1 (1 represents perfect performance) based on the number of hits and false alarms (Green and Swets, 1966, as cited by: Pagnoni & Cekic). The results (ANCOVA and group-wise Pearson's correlation analyses) showed that, while target sensitivity and speed to respond decreased with age in control participants, they remained virtually constant in those who meditate. One limitation from this study acknowledged by the authors is the relatively small numbers of participants.

Another study demonstrated that Mindfulness impacts sustained attention at the other end of the age spectrum; with five through to eight year old children. The randomized control trial designed by Napoli, Krech & Holley (2005) had 97 children in both the experimental and non-active control groups. The experimental group partook in the Attention Academy Programme where students participated in exercises designed to facilitate being in the moment, such as attending to the breath, body scans, and movement and sensorimotor awareness activities. The group met 12 times over a 45 week period for 45 minutes. Attention was measured using the Test of Everyday Attention for Children (TEA-Ch), which features five subtests measuring sustained and selective attention (Manly et al., 2001). The students in the experimental group showed an increase in selective attention, as well as a reduction in test anxiety and a reduction in problem behaviours (as rated by their teachers).

Response intention, selection and control (Cohen, 1993) (and executive control; Posner & Rothbart, 2007) have also been implicated in Mindfulness (Tang et al., 2007; van den Hurk, Gionni, Gielen, Speckens & Barendregt, 2009). Tang and colleagues (2007) used the ANT to measure the impact of short-term Mindfulness training. In a randomised control trial, 40 participants in the experimental group were taught Integrative Body-Mind Training (IBMT). IBMT comes from traditional Chinese medicine and incorporates aspects of other meditation training, such as body relaxation, breathing adjustment, and mental imagery in addition to mindfulness training. The training was held over five days for 20 minutes per day. The 40 control subjects participated in the same number and length of group sessions, but received information about the relaxation of each body part. The ANT involves responding to an arrow target that is surrounded by flankers which either point in the same or opposite direction. Before training no differences were found for alerting, orienting and executive networks. Conflict resolution scores after training, however, were significantly higher for the experimental group, a task which relies on executive attention (Posner & Rothbart, 2007) (or response intention, selection and control; Cohen, 1993). No significant differences between the groups were found on the other measures of the ANT: orienting and alerting. While this study offers valuable information on the effect of brief meditation

training on the subsystems of attention in comparison to relaxation, this is limited by the intervention incorporating elements other than simply mindfulness.

Van den Hurk and colleagues (2009) found executive attention skills to also be significantly higher in expert mindfulness meditators (mean: 14.5 years, range 3 months to 35 years) compared to 20 matched controls. The 20 healthy meditators had regular Mindfulness practices which varied from 60 to 420 minutes a week. The ANT was similarly implemented, with one training block of 24 trials and three test blocks of 94 trials each. The study found improvements in alerting (Posner & Rothbart, 2007) (capacity focus; Cohen, 1993).

Slagter, Lutz, Greischar, Nieuwenhuis & Davidson (2009) found a long-term Mindfulness-based retreat to impact capacity focus (Cohen, 1993) (alerting; Posner & Rothbart, 2007) when at rest. The 17 participants in the experimental group engaged in a three month vipassana-style retreat, called Insight, which involves 10-12 hours of meditation per day. They were matched with 23 inactive controls. The authors wanted to investigate the impact Mindfulness had on the attentional blink test. This test illustrates a major limitation in human information processing: the brain's difficulty in processing two temporally close meaningful stimuli. When the second of two target stimuli (T2) follows the first (T1) within 500 msec amongst a rapid stream of distracters, it often goes unnoticed (Shapiro, Raymond & Arnell, 1997a). It is believed that when many resources are devoted to processing T1, too few are left available for T2 processing, leaving its representation vulnerable to interference from distracters (Shapiro, Raymond & Arnell, 1994). EEG monitoring occurred while participants completed the test. The results were that successful target detection was associated with enhanced theta phase locking. This was a novel finding that the authors emphasise demonstrates a role for local phase synchrony of oscillatory theta activity in conscious target perception. The meditation training was shown to be associated with enhanced theta phase locking after successful detection of T2, in particular for those with the greatest reduction in T1 elicited P3b amplitude. P3b amplitude is theorised to be proportional to the amount of attentional resources engaged in a given task (Johnson, 1993; Kramer & Spinks, 1991; Polich & Kok, 1995). These results suggest that Mindfulness can significantly affect the

way stimuli are processed and perceived. Since the participants were not engaged in formal meditation during the assessment, the authors suggest that Mindfulness training can reduce the tendency to “get stuck” on a target, as reflected by the reduction in T1-elicited P3b amplitude – which seems to leave resources more quickly available to process information related to momentary experience (as was seen with both reduced variability in successful T2 detection and improved T2 accuracy).

Sustained attention is also improved by Mindfulness training (Chambers, Lo & Allen, 2008; Lutz et al., 2009). Chambers et al. compared a group of 20 participants engaging in their first 10-day vipassana retreat with 20 matched controls. Self-report scales measured mindfulness (MAAS), rumination (The Ruminative Responses Scale [RRS], a subscale of the Response Styles Questionnaire, [RSQ]; Nolen-Hoeksema & Morrow, 1991), affect (Beck Depression Inventory [BDI], Beck, Rush, Shaw, & Emery, 1979, as cited by: Chambers et al, 2008, Beck & Steer, 1987, as cited by: Chambers et al., 2008; Beck Anxiety Inventory [BAI], Beck, Epstein, Brown, & Steer, 1988; Positive and Negative Affect Schedule [PANAS], Watson, Clark, & Tellegen, 1988). Performance tasks assessed working memory using the Digit Span Backward (DSB) subscale of the Wechsler Adult Intelligence Scale-3rd edition (WAIS-III) to provide an index of sustained attention and attention switching using the Internal Switching Task (IST), a new experimental task created for this study. Both the self-report and performance measures were taken before and after meditation training. Results showed that the mindfulness training was related to significant improvements, in comparison to the control group, in self-reported mindfulness, depressive symptoms, rumination, and performance measures of sustained attention and working memory, but not in attention switching. A limitation of note is that this was not a randomized control trial, and participants in the control group were both on the waiting list for their own meditation retreat and students from post-graduate psychology.

At a different level of investigation, Magnetic Resonance Imaging (MRI) has shown experienced Insight meditators to have a thicker cortex, particularly in brain regions associated with attention: the prefrontal cortex (PFC) and right anterior insula cortex (right AIC) (Lazar et al., 2005). The differences between the 20 participants in the experimental group and the 15 matched controls, were most

pronounced in the prefrontal cortex of older participants. The authors interpreted this result as suggesting that meditation may offset age-related cortical thinning. The thickness of these two regions correlated with meditation experience, as measured through number of years and change in respiration rate (a physiological measure of cumulative meditation experience).

With a relatively rare methodological structure one study has shown that different types of Mindfulness teaching can impact attentional processes differently. Jha, Krompinger & Baime (2007) compared three different groups: a meditation naive MBSR group, a one-month mindfulness retreat group who had prior experience with concentrative meditation, and a meditation naive, inactive control. There were 17 healthy participants in each of the groups. All were tested on the ANT at two different time points. The retreat participants were tested at the beginning of the one-month retreat (10-12 hours of meditation per day) and at the end. The MBSR group were first tested before the beginning of the MBSR class, and again within 10 days of the conclusion of the 8-week class. At Time 1, the participants in the retreat group displayed higher conflict monitoring skills relative to those in the MBSR and control groups, suggesting an impact from their exposure to concentrative meditation. At Time 2, the participants in the MBSR group showed significantly improved orienting (selective attention; Cohen, 1993) in comparison with the retreat participants and the controls. The retreat group demonstrated differences in performance on the alerting component (capacity focus; Cohen, 1993), where their exogenous stimulus detection was improved in comparison to the MBSR group and the controls. The difference in attentional effects associated with the different forms of Mindfulness training is of interest. The authors concluded that Mindfulness training may enhance the functioning of each of the attentional subsystems at various points in the course of mindfulness training.

Thus, it may be that different forms and/or durations of Mindfulness training strengthen different aspects of attention. From the attentional literature reviewed here we can see that an average of three years of Zen training (Pagnoni & Cekic, 2007) can impact selective attention. Although 45 minutes of Mindfulness training delivered over 12 sessions during a 45 week period (Napoli et al., 2005) had no impact on sustained attention. 20 minutes of IBMT training over five days (Tang et al., 2007), by

contrast, had a significant impact on conflict resolution (a task that involves response intention, selection and control) (Cohen) (Executive Control, Posner & Rothbart, 2007), yet no impact on selective attention or capacity focus. Expert Mindfulness meditators (average 14.5 years experience) showed significant improvements in response intention, selection and control but no difference in capacity focus (Van den Hurk et al., 2010). Slagter et al. (2009), by contrast, showed significant improvements in capacity focus could come from a 3-month Vipassana course. Whereas, first-time 10-day Vipassana participants showed improvements in sustained attention but no improvements in attention switching (a task controlled by response intention, selection and control) (Chambers et al., 2009). Clearly, there is vast discrepancy amongst the literature about what subsystems of attention are impacted by Mindfulness. Although, it is clear that Mindfulness is associated with an impact on attention. Larger sample sizes are required in future research to provide stronger evidence and a more clear understanding of how mindfulness impacts attention. To further clarify the precise mechanisms of attention that mindfulness is associated with, further research could examine the distinctions between different forms of Mindfulness teachings, and the impact that training in those methods for varying lengths of time has on the sub-processes of attention. The understanding of how Mindfulness impacts attention will be further facilitated as more is discovered about the sub-processes of attention themselves. Of primary importance is investigating how they relate to one another, what the more elementary processes are that make up the sub-processes, and how these elementary processes interact with one another.

Emotional Regulation and Mindfulness

The training of attention through Mindfulness practice is believed to contribute to the development of greater emotional regulation skills (Lutz, Slagter, Dunne & Davidson, 2008). While emotions have been disregarded historically, they are now considered vital signals for optimal functioning. The impact of emotions on cognitions has led to the growing interest in how emotions are regulated. While most emotional regulation theories emphasise cognitive strategies, Mindfulness practice has been proposed as offering an alternative method for the regulation of emotions. Evidence for Mindfulness' capacity as

an emotion regulation technique is witnessed through its reduction of rumination (Ramel, Goldin, Carmona & McQuaid, 2004; Chambers, Lo & Allen, 2008; Labell, Campbell & Carlson 2010; Jain et al., 2007), as well as its impact on the amygdala (Taylor et al., 2011; Way, Creswell, Eisenberger & Leiberman, 2010): a region of the brain known for its involvement in emotion and stress.

Emotions have a powerful influence over human judgements and behaviours. Historically, their function and purpose has been discredited, with Plato considering emotions, and affective reactions in general, to be foolish counsellors (Bargh & Williams, 2007). Descartes, two millenia later, continued to view emotions as afflictions that biased and obscured thought and decisions (Bargh & Williams, 2007). Darwin, however, argued for the functional and adaptive nature of emotional expression (Bargh & Williams, 2007). His argument gradually influenced scientific psychology which began the experimental study of the interaction between emotion, cognition, and behaviour (Bargh & Williams, 2007). Today, researchers involved in emotion regulation generally view emotions as whole-body responses that signal personally relevant, motivationally significant events (Frijda, 1987; Levenson, 1999). Cognitive neuroscience documents how emotional processing is involved as a moderator or guide in many cognitive processes. The relationship between the two is so intimate that Davidson and Irwin (1999) concluded “The circuitry that supports affects and the circuitry that supports cognition are completely intertwined” (p. 12). Emotions are now considered phenomena that are designed to signal us, as well as guide and shape cognitive processing (Bargh & Williams, 2007).

The discovery of emotions’ relationship with cognitions (and consequently goal setting and achievements) sparked interest in how emotions can be regulated. Emotional Regulation (ER) involves a range of strategies that can be implemented at varying stages during the emotion-generative process to influence which emotions arise, when and how long they occur, and how they are experienced and expressed (Gyurek, Gross & Etkin, 2011). Adaptive ER is assumed to be intrinsic to mental health and adaptive functioning generally (Gross & Munoz, 1995), even in early developmental years (Cole, Martin & Dennis, 2004). Adaptive ER may initiate, increase, maintain or decrease emotions in flexible and appropriate response to changing environmental factors (Parrott, 1993). This maintains the

individual within a “window of tolerance” between hypo- and hyper-arousal, where optimal social functioning and goal engagement can occur (Chambers, Gullone & Allen, 2009).

While emotion regulation is a relatively new area of study, researchers typically agree that it involves a number of cognitive strategies. Consensus on the precise strategies has not been agreed, but the more widely acknowledged strategies are described. *Response modulation* strategies involve decreasing, suppressing, increasing or enhancing emotional responses, dependent on how appropriate or helpful the emotion is for the current situation and one's purposes. *Attentional deployment strategies* modify or redirect the focus of conscious attention in order to modify the emotion experienced in relation to a particular stimulus. *Cognitive transformation or reappraisal* involves recategorization of the situation or stimulus that is producing the emotion so that its meaning or emotional significance is changed. Behavioural forms of ER include *situation selection*, which involves seeking out or avoiding situations that have a tendency to produce particular emotional reactions; and *mood repair* where one deliberately engages in an activity that alters the emotion one wishes to regulate (Bargh & Williams, 2007; Chambers, Gullone & Allen, 2009). It is thought that the frequent and consistent repetition of these conscious ER strategies lead to the non-conscious and automatic employment of that strategy over time (Bargh & Chartrand, 1999; Bargh & Williams, 2007). Being a new field of investigation there is not a complete consensus on how ER should be precisely operationalized (Chambers et al., 2009).

Mindfulness meditation has been linked to the use of adaptive ER strategies (Kabat-Zinn, 1994; Feldman, Hayes, Kumar, Greeson & Laurenceau, 2007). However, the exact relationship between Mindfulness and the ER strategies discussed are currently unclear (Goldin & Gross, 2009). Indeed, Chambers et al. (2009) vocalise that Mindfulness is antithetical to response modulation and cognitive appraisal. Response modulation consists of altering one's emotional responses, whereas Mindfulness teaches an increasing awareness of, as well as an abstaining from, elaboration, diminishment or any other form of emotional alteration, regardless of its apparent valence, intensity, or perceived value. Chambers et al. acknowledge that response modulation may be adaptive when it is necessary to inhibit the escalation of anger and anxiety, as demonstrated by Butler et al (2003; cited by: Chambers et al.) or

in the maintenance of optimal interpersonal distance between people which allows for smooth social interaction (Clark & Taraban, 1991; as cited by: Chambers et al., 2009).

Response modulation, particularly the act of suppression, has maladaptive effects. Firstly, it does not appear to reduce the experience of negative emotions (Gross, 1998; Richards & Gross, 1999). Secondly, it has been shown to decrease the experience of positive emotions (Gross & Levenson, 1997). Thirdly, it has been associated with negative social consequences, such as reduced interpersonal responsiveness during face-to-face interaction, negative partner-perceptions and hostile behaviour (Butler et al., 2003; Butler, Lee & Gross, 2007). Fourthly, it has been shown to impair incidental memory for information presented during the suppression period (Gross, 2002; Richards & Gross, 1999). Lastly, modulating emotional response through suppression has shown to increase cardiovascular activation (Richards & Gross, 1999; Butler et al., 2003).

Cognitive transformation or reappraisal has received empirical support as a more adaptive form of ER than response modulation (Gross & John, 2003). It has been shown to decrease emotional experience without any observable detrimental physiological effects, whilst also enhancing the sense of meaning making (Butler et al., 2003; Fredrickson, 2003). However, Chambers et al. (2009) discuss the risk involved: it may result in experiential avoidance when its use is motivated by an unwillingness to experience or remain in contact with a particular emotion associated with the initial appraisal. Hayes & Feldman (2004) have demonstrated that experiential avoidance of emotions can cause psychological harm. Experiential avoidance is specifically targeted in Mindfulness trainings, and cognitive reappraisal differs fundamentally from Mindfulness which emphasizes simple, non-reactive observation of initial appraisals without altering them to something perceived as more beneficial (Chambers et al., 2009).

Mindfulness may be providing a new form of emotional regulation (ER) than recognised by previous ER models - which depend on cognitive mechanisms attempting to alter and 'fix' experience. Mindful awareness may facilitate a healthy engagement with emotions (Hayes & Feldman, 2004), allowing individuals to genuinely experience and express their emotions without under-engagement (i.e. experiential avoidance and suppression) or over-engagement (e.g. rumination) with them. Since

Mindfulness promotes the early awareness and non-judgemental observation of emotional stimuli (Goldin & Gross, 2010), it seems to allow people to engage in regulation early in the time course of stimulus processing before intense emotional responses occur (Teper, Segal & Inzlicht, 2013; Gross & Thompson, 2007).

While the precise mechanisms through which Mindfulness impacts ER are not yet fully understood, Siegel (2007) has proposed a credible theory that has gained the support of other prominent researchers in the field (Teper, Segal & Inzlicht, 2013; Farb, Anderson & Segal, 2012; Davis & Hayes, 2011). Siegel's theory is based on how the altering of attention through Mindfulness changes our relationship with our own mental processes. As Mindfulness enhances the clarity and depth through which we can view our own minds we can come to notice earlier in the process when our minds are automatically moving down detrimental routes. By observing our thought processes doing so, without actively engaging in them, we can end the patterns of habitual thinking at an increasingly quickened rate. According to Siegel, through Mindfulness practice we come to notice the difference between sense and story, between primary experience-dependent 'bottom-up' input and the secondary 'top-down' chatter of prior learning. Once this distinction becomes accessible to conscious awareness through Mindfulness practice, we no longer become lost in top-down mental processes (such as, self-preoccupied rumination, self-defeating thought-patterns, negative autobiographical narratives or maladaptive patterns of emotional reactivity). Siegel proposes that with repetition, these intentional states of brain activation are able to become long-lasting traits through neural plasticity.

In accordance with Siegel's theory, research indicates that Mindfulness is associated with a reduction in rumination (Ramel, Goldin, Carmona & McQuaid, 2004; Chambers, Lo & Allen, 2008; Labell, Campbell & Carlson 2010; Jain et al., 2007). Rumination has been defined by influential mood-regulation researcher, Noelen-Hoeksema, as: “a coping response to negative mood involving self-focused attention, characterized by a repetitive and passive focus on one’s negative emotions” (cited by: Deyo, Wilson, Ong & Koopman, 2009, p. 265). Studies have shown that in healthy individuals with no prior history of depression the presence of rumination is a risk factor for future onset of major

depressive disorder (Spasojevic & Alloy, 2001; Nolen-Hoeksema, 2000). Ramel et al. (2004) found that after an MBSR course scores on a validated rumination measurement, The Ruminative Responses Scale (RRS), significantly decreased. The RRS is a subscale of the Response Styles Questionnaire, (RSQ; Nolen-Hoeksema & Morrow, 1991), which distinguishes between two dimensions of rumination: brooding and reflection. Tests were completed immediately pre- and post-MBSR by both the 11 participants in the experimental group and the 11 in the wait-list control. A repeated measures ANOVA was conducted with one within-subject factor (time) and one between-subject factor (completers vs. waitlist). Overall rumination scores decreased significantly between the Mindfulness group and the Control ($F(20) = 10.78$, $p < .004$) with a large effect size: Cohen's $d = 1.47$. Statistical analysis of the two separate dimensions of the RSQ showed reflection to be significant [$F(20) = 5.52$, $p < .03$; Cohen's $d = 1.05$], while brooding was not-significant, but approaching significance [$F(20) = 3.88$, $p = .063$; Cohen's $d = .88$]. These results showed that learning Mindfulness through MBSR lead to decreases in the reflection component of rumination, but not brooding (Ramel et al., 2004).

Chambers, Lo & Allen (2008) found similar results on the RSQ after a Vipassana retreat, with a slightly higher participant group. Their group of 20 first-time Vipassana meditators completed a 10-day retreat, while 20 participants were drawn from Vipassana waiting lists as well as undergraduate and postgraduate psychology classes to act as their control. Mindfulness scores (MAAS) decreased significantly from pre MBSR to post MBSR for the experimental group as well as significantly decreasing in comparison to the control. Similar to Ramel, Goldin, Carmona & McQuaid's (2004) study, the novice meditators showed a significant reduction on the reflection dimension of the RSQ in pre-post test comparisons, as well as comparisons with the control group ($F(38) = 8.57$, $p < .01$), with a large effect size: Cohen's $d = 0.95$. The brooding dimension, however, was yet again insignificant both in pre-post test comparisons, and comparisons with the control group. Interestingly, reflection on the RSQ is considered to be less clearly linked with depressive and anxious symptoms than brooding (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The authors of both studies have offered the same possible explanation. Ramel and colleagues (2004) noted that reflection describes a tendency to

ruminate on the meaning of one's emotions and behaviours, whereas brooding is of a more self-derogatory nature. Thus, the decrease of the reflective aspect of rumination may be because reflective tendencies are more salient than brooding in healthy participants, while brooding may be more salient in those with depressive symptoms.

Labell, Campbell & Carlson (2010) investigated the impact of MBSR on a post cancer-treatment population. 46 women were involved in the treatment group compared to 31 in the wait-list control. Pre- and post-tests included the measurement of mindfulness levels (MAAS) and the measurement of rumination through the Rumination–Reflection Questionnaire—Rumination subscale (RRQ-Rum; Trapnell & Campbell, 1999). The results found those who completed the programme improved significantly in mindfulness scores while significantly decreasing on rumination scores ($F(1,72) = 11.04, p < .01$), with a large effect size (Cohen's $d = .92$) compared to waiting controls.

Mindfulness, however, has not demonstrated a significant impact on rumination beyond that induced by somatic relaxation.

In one randomised-control trial Jain et al. (2007) compared 27 participants in a Mindfulness group, 24 in a relaxation, and 30 in an inactive control. The Mindfulness intervention was based off the MBSR structure, but shortened to fit with the undergraduates timetables (four 1.5-hr sessions, compared with the eight 2.5-hr sessions of MBSR). The relaxation group were taught various forms of somatic relaxation, with the emphasis being on relaxation of the body. Rumination levels were measured pre and post interventions with the Daily Emotion Report (DER; Nolen-Hoeksema, Morrow & Fredrickson, 1993). The DER is a self-report questionnaire designed to assess distractive and ruminative thoughts and behaviours associated with depression. ANCOVA analyses were conducted with post-intervention scores of the DER, using pre-intervention scores as covariates. Post hoc Tukey tests demonstrated that the meditation group post-intervention mean showed significantly less rumination and depression than the control group mean ($p = .003$), with only a trend in the direction of significance when compared with the relaxation group mean ($p = .06$).

In summary, it seems as though Mindfulness is associated with the significant reduction of rumination – a key skill for an emotional regulation technique. Several studies have demonstrated MBSR's (or a shortened versions) association with a significant decrease in rumination in comparison with controls (Ramel, Goldin, Carmona & McQuaid, 2004; Labell, Campbell & Carlson 2010; Jain et al., 2007), and 10-day Vipassana retreats has shown to have a similar effect (Chambers, Lo & Allen, 2008). Interestingly, only the reflection aspect of a ruminative measure (RRS) has been significantly impacted by Mindfulness interventions, while the brooding aspect has not. To test the theory held by researchers, future studies should investigate the impact of Mindfulness on rumination in participants with depressive symptoms, using the Ruminative Responses Scale (RRS). While one study has shown that Mindfulness does not alter rumination at a statistically significant level when compared with somatic relaxation (Jain et al., 2007), it may be that the duration of the Mindfulness intervention used was too short. The beginning stages of Mindfulness may have more of a relaxing impact. It may take time for cognitive tendencies such as rumination to be consciously undone, in the way Siegel (2007) has proposed. It would be beneficial for future research to use longitudinal designs or expert meditators in comparison with long-term users of relaxation techniques to further clarify the differences and similarities between the impact on rumination by Mindfulness and relaxation techniques.

The reduction of amygdala activity that has been associated with Mindfulness interventions adds further support to Mindfulness's ER capacity (Taylor et al., 2011; Way, Creswell, Eisenberger & Leiberman, 2010; Goldin & Gross, 2010). The amygdala is a brain region that has been associated with contributing to negative affective experience by increasing perceptual sensitivity for negative stimuli (Barrett, Bliss-Moreau, Duncan, Rauch, Wright, 2007). The amygdala's role in the stress response will be discussed later. In a study with a small participant group Mindfulness was associated with the reduction of emotional intensity perceived from images (Taylor et al., 2011). This attenuation was associated with different brain regions, according to expertise level: the amygdala for beginners, and the default mode network (DMN) for experienced. Twelve experienced Zen meditators with more than 1000 hours of practice were compared with the 10 beginner meditators who partook in 20 minutes of

Mindfulness practice for seven days before testing began. Testing involved fMRI scanning as the meditators viewed negative, positive, and neutral pictures in a mindful state and then a non-mindful state of awareness. Both groups experienced a significant decrease in self-reported emotional intensity in the Mindfulness conditions compared with ordinary awareness, with no main effect or interaction found between the groups. A one-way repeated measures ANOVA was thus conducted which found a significant main effect of Mindfulness on the processing of negative pictures ($F(1, 18) = 6.23, p = .022, \eta^2 = .25$), such that negative pictures viewed in a state of mindfulness were rated as less intense ($M = 1.93, SD = 0.65$) than negative pictures viewed in a normal state ($M = 2.16, SD = 0.71$) (Cohen's $d = 1.12$). While the attenuation of emotional intensity did not differ according to expertise level, the fMRI data suggested that the effect was achieved through distinct neural mechanisms for each group. For experienced meditators relative to beginners, Mindfulness induced a deactivation of the DMN (medial prefrontal and posterior cingulate cortices) across all valence categories and did not influence responses in brain regions involved in emotional reactivity during emotional processing. In contrast, the beginners exhibited a down-regulation of the left amygdala during emotional processing in the Mindfulness condition, when compared to the expert meditators. The authors interpreted these results in a manner that supports Siegel's (2007) theory. Taylor et al. (2011) suggest these results indicate that long-term Mindfulness practice leads to emotional stability through eliciting acceptance of emotional states and enhanced present-moment awareness, rather than encouraging control over low-level affective cerebral systems from higher order cortical brain regions.

A study by Way, Creswell, Eisenberger & Leiberan (2010) has linked dispositional mindfulness to protective non-reactivity in the amygdala in response to affect provoking material. Trait mindfulness was measured in the 27 participants using the MAAS. While undergoing fMRI participants viewed emotionally expressive faces. They had two tasks. During the affect labelling task, participants chose the affect label from a pair of words shown at the bottom of the screen ('angry', 'scared') that matched the target face. During the gender labelling task, the participants chose the gender-appropriate name from a pair of names shown at the bottom of the screen ('Samuel', 'Helen') that matched the target face.

The gender labelling task was a comparison condition to control for the general cognitive processing demands of the affect labelling task. Analyses found that participants high in trait mindfulness demonstrated decreased amygdala responses when viewing threatening and fearful faces whereby the dispositional mindfulness variable was negatively correlated with amygdala activation with a large effect size (Cohen's $d = 1.25$), where no such association was found in those with low levels of dispositional mindfulness.

In summary, Mindfulness may be providing a new form of ER to that recognized by previous ER models which rely on cognitive mechanisms attempting to alter and 'fix' emotions. By contrast, mindful awareness may facilitate a healthy engagement with emotions. This allows emotions to be genuinely experienced and expressed without under- or over-engagement (i.e. experiential avoidance, suppression and rumination). Mindfulness's capacity for ER has been demonstrated through its association with significant reductions in rumination, as well as reduction of amygdala activity. These findings lend support to Siegel's (2007) prominent theory which suggests that the enhancement and clarity of depth achieved through Mindfulness allows the increasingly quickened rate of noticing when our minds are automatically moving down detrimental routes, and that the repetition of these intentional states of brain activation are able to become long-lasting traits through neural plasticity.

The Relaxation Response and Mindfulness

Mindfulness is commonly cited for its relaxation effects (Chambers, Gullone & Allen, 2009). While relaxation is not a core process of Mindfulness (Baer, 2003), relaxation seems to be a beneficial side-effect through which further positive effects can occur. Meditation in general has shown to elicit the relaxation response (Benson, Greenwood, & Klemchuk, 1975), a state which includes: decreased heart rate; respiratory rate; blood pressure; and oxygen consumption. The relaxation response is the physiological opposite of the stress response (fight-flight-freeze response) (Wallace & Benson, 1972). The stress response is facilitated by the release of cortisol (Cahn & Polich, 2006). Evidence indicating that cortisol levels are also associated with dispositional mindfulness levels is accumulating (Brown,

Weinstein & Creswell, 2012; Daubenmier, Hayden, Chang & Epel, 2014; Zimmaro et al., 2016), while results on the impact of relatively short-term Mindfulness interventions on cortisol are currently inconsistent.

Herbert Benson notably introduced the concept of the relaxation response in 1972 to describe the physiological changes induced by meditation (Wallace & Benson, 1972). He defined it as follows:

“Briefly stated, the relaxation response is defined as the response that is the opposite of the ‘fight-or-flight’ or stress response. It is characterized by the following: decreased metabolism, heart rate, blood pressure, and rate of breathing; a decrease or ‘calming’ in brain activity; an increase in attention and decision-making functions of the brain; and changes in gene activity that are the opposite of those associated with stress” (Wallace & Benson, 1972, p. 5). The relaxation response consists of four physiological changes: decreased heart rate, respiratory rate, blood pressure, and oxygen consumption (Benson, Greenwood, & Klemchuk, 1975). Four elements were proposed by Benson (Wallace & Benson, pp. 59-61) as necessary for eliciting the response: (a) a quiet environment; (b) a mental device; (c) a passive attitude; (d) a comfortable position. The *mental device* was Benson’s requirement of a constant stimulus (such as a sound, word or external object to gaze upon). Whilst this recommendation is more aligned with concentrative styles of meditation the purpose of the mental device is to shift the mind from logical, externally oriented, distracting thought. Mindfulness, with its own method of reducing the tendency to ‘get caught’ in distracting thought may also promote the relaxation response. This idea is supported by Benson (Wallace & Benson, 1972) emphasising the *passive attitude* as the most important element in eliciting the relaxation response. This passive attitude he described as a “let it happen” attitude (Wallace & Benson, 1972, p. 60), which is akin to mindfulness. Research on changes to blood pressure adds further support to the notion that Mindfulness interventions also elicit the relaxation response. By 1997, there were more than nineteen studies showing Mindfulness to successfully lower blood pressure in normal to moderately hypertensive participants (Murphy, Donovan & Taylor, 1997). During the relaxation response, the parasympathetic nervous system becomes activated which consequently reduces stress-related somatic arousal (Cahn & Polich, 2006).

When the human organism is threatened by physical or psychological stressors, the system engages in *allostasis* to re-establish *homeostasis* in the body while adapting to these new conditions (Matousek, Dobkin, & Pruessner, 2010). Cortisol is one of the primary chemical mediators of allostasis. Allostasis is the process of achieving homeostasis - the organism's capacity to maintain certain bodily functions (e.g. body temperature and oxygen levels) within a vital and optimal narrow range, despite disturbances in its internal and external environment (Canon, 1929, as cited by: Matousek, Dobkin, & Pruessner, 2010). The hypothalamic-pituitary-adrenal (HPA) axis facilitates allostasis by providing the system with enough energy to cope with the stressors. The hypothalamus secretes corticotropin-releasing hormone, which reaches the anterior pituitary gland, stimulating the release of adrenocorticotrophic hormone (ACTH). ACTH is then secreted into the blood-stream where it eventually stimulates the release of cortisol by binding with receptors on the adrenal cortex. The amygdala is responsible for coordinating the perception of stress (by relaying information to the HPA system), as well as receiving and responding to cortisol conveying signals of stress from the adrenal gland (Zimmaro et al., 2016). The release of cortisol is understood to promote survival functions in the face of an acute stressor by increasing blood pressure, increasing blood sugar levels, promoting analgesia, and simultaneously conserving energy from non-vital functions by suppressing reproductive, immune and digestive functions (Matousek, Dobkin, & Pruessner, 2010). Thus, cortisol's main function is to restore homeostasis following exposure to stress (Gatchel, 2009). While the release of cortisol is protective in the short-term, continually elevated levels have damaging effects (de Kloet, Oitzl, Joels, 1993).

Cortisol follows a distinct diurnal pattern. At waking, cortisol levels begin to rise and reach peak between 30-45minutes later. After peaking, levels steadily decline throughout the day (O'Leary, O'Neill & Dockray, 2015). The rise from waking to peak is known as the cortisol awakening response (CAR; Pruessner et al., 1997). The measurement of cortisol is highly sensitive and can be influenced by time of sampling and incorrect sampling (O'Leary, O'Neill & Dockray, 2015). When it is assessed on consecutive days, close to half of the variance in both cortisol level and diurnal slope is stable between-person variability, and half is idiosyncratic to the day (Segerstrom, Boggero, Smith & Sephton, 2014).

As intervals increase to weeks or months, the proportion of stable between-person variability decreases to around 10% (Segerstrom, Boggero, Smith & Sephton 2014). Additionally, the CAR (rather than average or total cortisol levels throughout the day) has been recommended as the appropriate measure of HPA functioning (Chida & Steptoe, 2009). Given the difficulty in measuring cortisol, the implementation of appropriate and rigorous sampling methods is essential for accurately measuring cortisol levels.

Trait mindfulness is steadily being associated with cortisol levels (Brown, Weinstein & Creswell, 2012; Daubenmier, Hayden, Chang & Epel, 2014; Zimmaro et al., 2016). Zimmaro et al. (2016) explored the relationship between dispositional mindfulness, cortisol levels and perceived stress. Eighty-five undergraduate students had their cortisol levels measured on two different days, approximately one month apart (20-52 days). Diurnal cortisol mean was used - created from the combination of CAR (30-45minutes after waking) and diurnal cortisol slope - taken at bedtime. Other measures included the MAAS (for dispositional mindfulness), and the perceived stress scale (PSS; Cohen, Kamarack & Mermelstein, 1983). Shift workers were excluded from the study as shift work may alter cortisol levels and circadian profiles (Kudielka, Buchtal, Uhde & Wüst, 2007). Primary hierarchical regression analyses established significant associations between mindfulness and perceived stress, perceived stress and mean cortisol, as well as between mindfulness and mean cortisol. Exploratory post hoc analyses used hierarchical regression to explore the potential for perceived stress mediating the relationship between mindfulness and cortisol, and in turn, for mindfulness mediating the relationship between perceived stress and cortisol. The post hoc results found that, when perceived stress levels were controlled for, mindfulness no longer significantly predicted cortisol levels ($\beta = .195$, $p > .05$), indicating that perceived stress fully mediated the relationship between mindfulness and cortisol. This relationship was bidirectional. When mindfulness levels were controlled for, perceived stress no longer significantly predicted cortisol ($\beta = .264$, $p > .05$). Thus, mindfulness also fully mediated the relationship between perceived stress and cortisol. The authors suggested the negative relationship between mindfulness and cortisol may show that individuals with higher dispositional

mindfulness may have more adaptive coping skills, resilience and approaches to stress which may lead these students to experience less perceived stress - thus lowering their physiological markers of stress. Conversely, mindfulness mediating a positive relationship between perceived stress and cortisol led the authors to suggest that those who perceived challenges as highly stressful may have been engaging more in future-oriented thinking or catastrophizing (non-mindful cognitions), which increased their physiological stress response. Notably, this study was limited by the collection of cortisol on only 2 days, with a variation of sample days between participants.

In another study using an undergraduate sample, Brown, Weinstein & Creswell (2012) investigated the role of mindfulness in buffering cortisol and affective responses to a social evaluative stress challenge. 44 students completed measures of trait mindfulness (MAAS), perceived stress (PSS), anxiety (Profile of Mood States Anxiety Subscale [POMS; McNair, Lorr & Droppleman, 1971], the Taylor Manifest Anxiety Scale [TMAS; Taylor, 1953]), negative affectivity (the Positive Affectivity Negative Affectivity Schedule [PANAS; Watson, Clark & Tellegen, 1988]), as well as their fear of negative evaluation (Fear of Negative Evaluation scale (FNE; Leary, 1983)). 22 participants were then randomly assigned to complete the Trier Social Stress Test (TSST; Kirschbaum, Pirke, Hellhammer, 1993). The TSST involves participants spending 5 minutes preparing a 5 minute speech before delivering it to a panel of two critical peer evaluators. Participants then perform a mathematical subtraction task before the same evaluators. The TSST reliably impacts hypothalamic-pituitary-adrenal (HPA) axis activation (Dickerson & Kemeny, 2004). The control group performed the same tasks alone, into a tape recorder (thereby omitting social evaluation). Baseline cortisol and self-reported state negative affectivity and state anxiety were collected before the task. These measurements were taken four times post-task, at standardised intervals of 45 minutes. Preliminary analyses found that the TSST produced significant changes in cortisol, negative affect and state anxiety. In a mixed model predicting cortisol response, a time x condition x dispositional mindfulness interaction was found ($F(1,166) = 5.12, p = .02$), with a medium effect size (Cohen's $d = 0.7$). Participants higher in mindfulness showed reduced cortisol responding in the social evaluative TSST condition but mindfulness was not associated

with cortisol responding in the control condition. The same three-way interaction was found in the model predicting ($F(1,187) = 3.83, p = .05$), with a medium effect size (Cohen's $d = 0.6$). A trend towards significance was found in the model predicting anxiety ($F(1,182) = 3.66, p = .06$). The results of Brown, Weinstein & Creswell (2012) indicate that dispositional mindfulness levels moderated cortisol responses to the TSST. Whereby, participants with higher trait mindfulness showed an attenuation of cortisol response to the social evaluative threat task.

Daubenmier, Hayden, Chang & Epel (2014) also examined whether mindfulness moderates the association between psychological distress and cortisol. The authors took measures from a sample of 43 women before they began a Mindfulness intervention. Dispositional mindfulness was measured using KIMS; Anxiety with the State-Trait Anxiety Inventory (STAI; Spielberger, 1983); Perceived stress using the PSS; Rumination using the Rumination and Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999); and negative affect with the PANAS. Cortisol levels were collected across 4 days at awakening and 30 minutes post-awakening. The CAR was calculated by subtracting the 30-minute post-waking value from the morning value. Values were averaged across days and participants with at least one full day of sampling were included in analyses. Separate regression analyses were used to test whether aspects of dispositional mindfulness measured by KIMS (Describe and Accept experience) moderated the relation between indicators of distress and the CAR. Results showed a similar pattern of interaction across all models. The association between the different measures of psychological distress and the CAR was positively related at lower levels of Accept (1 SD below the mean) but not at higher levels (1 SD above the mean). Similar patterns were found with Describe, although interactions with perceived stress and negative affect were not significant. The study was limited by measuring CAR at 30 minutes, when CAR can peak anywhere between 30 and 45 minutes. Some individuals' full CAR response may thus have been missed. The cross-sectional design (of a group who were interested in partaking in a Mindfulness intervention) may have made it difficult to ascertain whether some other element which is attracting them to learn Mindfulness accounts for the relationships found. The authors interpreted their results as suggesting that strong identification with or judgment of negative thoughts

and emotions may increase or prolong HPA axis activation, but this effect is mitigated if those thoughts and emotions are experienced with mindful awareness. The results obtained by Daubenmier, Hayden, Chang & Epel (2014) offer supportive evidence that dispositional mindfulness (particularly the acceptance component), moderates the association between psychological distress and the CAR.

The research investigating the impact of Mindfulness interventions on cortisol levels is less cohesive. While some studies have found significant decreases in cortisol (Carlson, Speca, Patel & Goodey, 2004; Marcus et al., 2003), others have found no impact (Klatt, Buckworth & Malarkey, 2008; Malarkey, Jarjoura & Klatt, 2013), and yet another study has found significant increases in cortisol levels following a Mindfulness intervention (Mikolajczak et al., 2010). Much of the research on the relationship between Mindfulness and cortisol has been plagued with methodological shortcomings such as, insufficient cortisol samples taken from each participant over an insufficient period, small sample sizes and inadequate controls. Interestingly, the vast majority of the research has only investigated the immediate impacts of short-term (approximately 8 weeks) Mindfulness interventions, with pre and post measures, sometimes compared with controls. It is possible a longer duration is required for Mindfulness interventions to make the necessary changes that result in physiological buffering of stress, as demonstrated through alterations in cortisol levels.

Outside of the Mindfulness literature, the cortisol literature itself is filled with contradictory results. Protective and vulnerability psychosocial factors have been associated with both decreased and increased CAR (Mikolajczak et al., 2010). Mikolajczak et al. (2010) tested whether CAR flexibility is a better indicator of psychological status than CAR magnitude. With a sample of 42 men measures of happiness, perceived stress and neuroticism were taken, as well as cortisol levels immediately on awakening, then at 15, 30, 45 and 60 min post-awakening over three consecutive days (i.e., Sunday, Monday and Tuesday). The men exhibiting protective psychological factors (i.e. high happiness, low stress, low neuroticism) had a lower CAR during weekends compared to weekdays, while those with vulnerability factors (i.e. low happiness, high stress, high neuroticism) had a CAR with the same magnitude during weekends and workdays. Mikolajczak et al. concluded and proposed that a flexible

CAR is a better indicator of psychological status than whether cortisol levels simply increase or decrease.

O'Leary, O'Neill & Dockray (2015) have used Mikolajczak et al.'s (2010) theory on cortisol flexibility to understand a study on dispositional mindfulness' association with CAR in cancer patients. Matousek, Pruessner & Dobkin (2011), found cancer patients exhibited significantly lower levels of cortisol at baseline than those in healthy controls. The participants may have been demonstrating a stiff and blunted CAR, as CAR is negatively associated with depression, fatigue and post-traumatic stress disorder (Chida and Steptoe, 2009), which can occur as a result of stressful, cancer-related experiences (O'Leary et al., 2015). Post-MBSR, the study found cortisol levels showed a significant prolonged increase after awakening ($F(2,64) = 7.16, p = .012$) when compared to pre-MBSR scores. This result was accompanied by significant improvements in self-reported stress levels, depressive symptoms and medical symptomatology. Matousek, Pruessner & Dobkin (2011) have stated that these results are also supportive evidence of cortisol flexibility being a better indicator of psychological status.

While the research on Mindfulness interventions association with cortisol is currently unclear, there is a strong suggestion that mindfulness is associated with cortisol levels. This implies mindfulness is decreasing stress-related physiological arousal. It is likely that mindfulness' impact on cortisol is caused by the elicitation of the relaxation response, the physiological opposite of the stress response (Cahn & Polich, 2006). As understanding further develops about cortisol's functioning and its relationship with relaxation and protective psychological functioning, understanding will further develop over how both Mindfulness interventions and mindfulness buffer stress. It would be beneficial for future research to utilize longitudinal designs where the maintenance of Mindfulness practice is factored into analyses. More rigorous methodological protocols are also necessary. Furthermore, it is imperative for future research to begin considering Mindfulness and mindfulness's association with cortisol flexibility, as opposed to focusing solely on decreases in cortisol levels.

The Buddhist concept of Self

In the context of exploring how mindfulness impacts the human organism, it is worthwhile examining how Buddhists believe this aspect of consciousness makes its impact. As previously discussed, mindfulness is a crucial part of the path to enlightenment. Enlightenment is understood to be synonymous with the permanent cessation of human suffering, which is believed to be caused by ignorance regarding the nature of reality (Siegel, Germer & Olendzki, 2008). The primary, erroneous belief tied to our ignorance is the concept of a permanent, individual ego or self (Gethin, 2011). Mindfulness, which provides the capacity for our awareness to rest at the level of bare attention, assists in correcting this distortion by enabling us to perceive reality as it really is. This is understood to be a reality devoid of permanent, enduring, individual selves. It is the letting go of identification with the construct of self that is the most significant mechanism through which mindfulness is believed to make its impact, according to the school of Buddhism.

Practitioners of Buddhist Mindfulness are encouraged to inquire into the nature of their self while holding the teachings on the concept lightly to promote the unveiling of their own realisations. The idea that there is no permanent, separate self is one of the key concepts of Buddhism (*anattā* in Pali). The fallacy of an individual self is considered the root ignorance of the human condition and the primary cause of our suffering. The sense that there is a self is believed to be an illusion that has been psychologically and socially created. It is understood to be reinforced by the interactions of different sets of impersonal mental and physical phenomena: the body, feelings, perceptions, impulses and consciousness (Loy, 1992). The self is believed to be a mental construct: a conditioned part of consciousness.

The majority of this section has been informed by David Loy's article, *Avoiding the void: The "lack" of self in psychotherapy and Buddhism* (Loy, 1992). Loy, a contemporary academic Buddhist Philosopher, describes the experience of self from a Buddhist perspective: "The experience of self is dependent on conditions, arising when they support it, abating when they do not. In this sense, the self is only another phenomenon in the flux of events, neither driving them, nor

being the recipient of experience, nor in any way separate from them. It is an event with no intrinsic enduring reality” (Loy, 2015, p. 212). He posits that whilst meditating, the self is being deconstructed (Loy, 2015). This, Loy (2015) claims, is because the self is mostly composed of habitual ways of thinking, feeling, intending, remembering, acting, and/or reacting. By being mindful of these processes that are impermanent and insubstantial the meditator gradually 'let's them go', thus, the parts that were once recognised as self are gradually deconstructed (Loy, 2015).

The sense-of-self (which he also refers to as *ego*) that has been constructed wants to experience itself as real, and it does so by objectifying itself in the world (Loy, 1992). However, this reifying and objectifying of self cannot succeed because the sense-of-self is not an elementary part of the individual. The consequence of this perpetual failure is that the sense-of-self experiences an inescapable sense of lack, from which it constantly tries to escape. Leaning on Harry Stack Sullivan's, as well as Freud's, ideas, Loy postulates that the self is initially constructed by the infant who finds it necessary to protect itself against the anxiety caused by the apprehension of disapproval from significant persons in its world. Rollo May (1996), an existential psychologist, noted that in anxiety: “The security base of the individual is threatened, and since it is in terms of this security base that the individual has been able to experience himself as a self in relation to objects, the distinction between subject and object also breaks down” (p. 112). The breakdown of this distinction between subject and object is viewed as psychosis within Western psychology (Loy, 1992). In Buddhism, however, it can describe enlightenment. Vasubandhu's (1964) writing on the experience of enlightenment demonstrates this: “Where there is an object there is a subject, but not where there is no object. The absence of an object results in the absence also of a subject, and not merely in that of grasping. It is thus that there arises the cognition which is homogeneous without object, indiscriminate and super mundane. The tendencies to treat object and subject as distinct and real entities are forsaken, and thought is established in just the true nature of one's thought” (p. 42). Loy emphasises that while both enlightenment and psychosis consist of the joining of subject and object, they are not one in the same. The question then becomes: “why the mystic can swim

in the same sea that drowns the psychotic” (Loy, p. 159). The similarities with psychosis aside, Buddhism holds that letting go the construct of self is the only way to truly end anxiety.

Anxiety is inextricably tied to the sense-of-self through two ways. Firstly, the sense-of-self was created to repress anxiety. Secondly, anxiety is the ego's response to its inability to ground itself, for being a constructed part of our functioning it has no discrete reality of its own and is therefore essentially groundless. It is insecure because there is nothing that it can truly secure itself to, it is simply a cluster of always-changing processes. Loy (1992) succinctly describes the sense-of-self as “an ungrounded awareness whose task it is to repress anxiety” (p. 161). According to Buddhist critique, the deep-seated anxiety of the constructed self is caused by its knowing on some level that it is not essentially real is a more immediate and pressing fear than the fear of death at some ambiguous point in the future. Thus, the belief in the self as a separate and enduring part of our being is considered the root cause of our suffering and the letting go of this reification will allow one to experience the cessation of suffering, or enlightenment.

The Buddhist path, according to Loy (2015), is nothing other than a way to resolve our sense of lack, or groundlessness. This path to enlightenment is walked by accepting and yielding to the groundlessness inherent in the self, because the actual problem is our deeply-repressed fear that our groundlessness is a problem. Through this acceptance and yielding one can discover they have “actually always been grounded, not as a self-contained being but as one manifestation of a web of relationships which encompasses everything” (Loy, p. 176). While we are driven by the lack that is inherent in identifying with a solid, autonomous self, every desire becomes an unhealthy attachment that attempts to fill a bottomless pit. Through the letting go of self, Buddhism posits we let go of lack, and enter into the grounding and serenity of no-thing-ness or groundlessness – the absence of any fixed nature. It is important to note that Buddhism does not consider it problematic that we have a self. The sense-of-self is indeed considered necessary to function in daily life (Loy, 2015). The school of thought does not advocate an abolishment of the sense-of-self. The problem, Buddhism postulates, lies in having a sense-of-self that both feels and believes it is separate from the rest of the world. The movement towards

enlightenment is then a letting go of the belief that we are a self which is a discrete entity separate from the rest of the world, while simultaneously and congruently navigating the world with the facilitation of our sense-of-self.

In Western culture, there is a traditional assumption that the self is a separate and enduring entity that exists in a real way prior to and apart from other people (Fulton, 2014; Gillihan & Farah 2005). Wheeler (1997) discusses how this assumption about our nature and our self-experience runs so deeply that it amounts to a cultural paradigm – an implicit belief system that colours our language and our experience in ways of which we are not fully aware. While the self, like many fundamental concepts in psychology is difficult to define, it is often recognised and measured through the following aspects: facial recognition, bodily recognition, agency (the sense of a link between the psychological self and the physical self—specifically, the recognition of being the cause of an action), trait, autobiographical memory and first-person perspective. In a comprehensive and critical review Gillihan & Farah (2005) examined available data from experimental psychology and cognitive neuroscience as it pertained to these areas of the self. The brain regions that are activated by these parts of self, as observed across imaging experiments, were compiled. The authors hypothesised that if the self is a unitary system the results would show clusterings of activation in certain regions or along certain networks. However, the compilation of imaging did not suggest common brain areas involved in the different aspects of the self. In fact, the evidence showed that even the individual aspects of the self within participants, between participants and between studies did not activate common areas. The results of the review led the authors to conclude that the self cannot be considered a separate, distinct aspect of the human being.

Despite Gillihan & Farrah's (2005) findings, there is a bias within cognitive neuroscience to assume that the self is a distinct feature. The authors narrow this down to the typical assumption of self, entering into the scientific realm in an unsubstantiated manner. They suggest that the experience of self may have more to do with the subjective nature of conscious awareness, rather than being explicable in terms of the mechanistic working of the brain (Gillihan & Farrah, 2005). Since the self cannot be located

within the physical anatomy of the brain it does raise the question of whether the subjective nature of a separate self has been either culturally influenced or created.

The academic Psychologist, Paul Fulton (Fulton, 2014), holds that the radical notion of not-self is empirically verifiable, not mere theory. He states that direct insight into the illusory nature of the self, and the consequential perception of the self as insubstantial and void of an enduring separate existence, leads to a drastic reorganization of the personality. According to Fulton (2014), this insight (which can be gradual or sudden) reduces our need for identity & self-esteem, defensiveness, aggression, and greed, as we come to understand that they are the source of our distress rather than the basis of safety and satisfaction. As insight into genuine interdependence develops, so does our sense of affinity and compassion with all other beings as well as taking things less personally. Fulton (2014) states that during Mindfulness practice there may be moments of alert awareness which are void of the sense that it is happening to 'me': the homunculus at the center of experience (Fulton, 2014). The process of the self arising in the moment can also be witnessed by this self-less awareness. Gradually, Fulton (2014) argues, these experiences change our perception of the self from a preoccupying "thing" demanding our protection, to an impersonal event.

The exploration of whether self exists beyond being merely a mental construct is an ambitious and evasive topic. With the merging of mindfulness and Buddhist ideas into psychology it is likely that this concept will undergo further examination and debate, given its centrality to Buddhist thought.

Meditation is not the Only Method for Eliciting and developing Mindfulness

While meditation is the most common practice for eliciting mindfulness, the cultivation of this trait is not limited to this practice (Cahn & Polich, 2006). It is likely that practices which fulfil the same requirements of the relaxation response that Mindfulness interventions do will also invoke a state of mindfulness. If so, these practices would produce decreased metabolism, heart rate, blood pressure, and rate of breathing. Alterations in cortisol may also be witnessed, as this is a hormone involved in the stress response, the opposite of the relaxation response. It is also likely that these practices would be

associated with changes in the use of attention, a reduction in the Default Mode Network (DMN), and an enhancement of emotional regulation.

Floataction-REST

Floataction-REST provides an environment that is likely to promote a state of mindfulness, and develop and cultivate trait mindfulness. Being the most sensory reduced environment available it fulfils Benson's requirement of “a quiet environment” (Wallace & Benson, p. 59). Having participants float effortlessly in a supine position, Benson's requirement of “a comfortable position” is also fulfilled by floataction-REST (Wallace & Benson, 1972, p. 60). Physiological indicators of the relaxation response (blood pressure) and movement away from the stress response (cortisol) have been associated with floataction-REST. Research has found blood pressure to be significantly reduced (Bood, Sundequist, Kjellgren, Nordstrom & Norlander, 2007; Caramano et al., 2015; Turner, Fine, Ewy, Sershon & Freundlich, 1989; Turner, Fine, McGrady & Higgins, 1987) and cortisol altered (Turner and Fine, 1983; Turner, Fine, Ewy, Sershon & Freundlich, 1989; Turner, Fine, McGrady & Higgins, 1987) after the use of floataction-REST. One of the prominent theories on the mechanisms of floataction-REST (Turner & Fine, 1993) can be mapped onto the theory of mindfulness, which further suggests that floataction-REST may be evoking a state of mindfulness. Furthermore, reports of thinking styles and stimuli attending that are experienced in floataction-REST indicate an orientation towards the present-moment and the heightened awareness of physical sensations. With these similarities in mind, it appears that floataction-REST may be a tool which evokes a state of mindfulness.

History of Floataction-REST

The floataction tank was invented in the 1950's for experimentation with perceptual isolation. Perceptual isolation was developed as an attempt to elucidate the effects of monotonous or reduced environmental stimulation on a range of psychophysiological, motoric, perceptual, cognitive, emotional, attitudinal, and other measures (Zubek, 1969). In this original research the manipulated

factors were variety and meaningfulness, and the participant lay on a bed with translucent goggles, gloves, and constant white noise for long periods of time. The absolute level of stimulation was not drastically altered from normal conditions, but the stimulation was homogeneous, unchanging and meaningless (Suedfeld, Ballard & Murphy, 1983). John Lilly (1956) created a variation of restricted stimulation where participants were submerged in a tank of water using a diving helmet or other apparatus to breathe. The helmet and water blocked incoming light and sound. The reported results of these experiences were dramatic and generally negative.

With Lilly's creation of the floatation tank (Lilly, 1977), these negative effects dissipated. The floatation tank removed the unnecessary and stressful experimental artefacts that had been previously used for reducing sensory stimulation (the excessive periods of time participants were left in these environments; the meaningless 'noise'; and the reliance on a breathing apparatus). The mindset for participants changed from abnormality and endurance, to conditions of reassurance and comfort over shorter periods of time (typically 1-2 hours). It was immediately reported to be: an extremely pleasant experience; conducive to enjoyable alterations in the state of consciousness; useful as a tool in therapy; and useful in enhancing mental and physical performance (Suedfeld, Turner & Fine, 2012). In one study (Suedfeld & Borrie, 1999), 90% of participants stated the session had 'gone very well', while 83% reported pleasant aspects. The major complaints were physical, rather than psychological, such as getting salt solution in the eyes, or about the air quality. With these significant changes, Suedfeld (1980) coined the term floatation-REST (Restricted Environmental Stimulation Technique) to separate this tool from the negative connotations that had been previously associated with sensory deprivation.

Today, floatation-REST has been involved in numerous areas of research. Several studies have shown floatation-REST to be associated with increased well-being, mild euphoria, increased originality, improved sleep, improved physical performance, reduced stress, reduced tension and anxiety, reduced blood pressure and reduced muscle tension (Bood et al., 2006). Despite these positive effects, research on the tool is limited. Suedfeld, Turner & Fine (2012) propose that the recent upsurge of commercial floatation-REST facilities may be responsible. A number of commercial facilities portray floatation-

REST as a panacea, which may have hindered its acceptance in clinical therapeutics (Suedfeld, Turner & Fine, 2012). A lot remains unknown about this tool due to the small quantity of floatation-REST research. The mechanisms through which it produces its effects, and the optimal periods and number of sessions for use, are yet to be established (Bood, 2007).

Floatation-REST Today

Floatation-REST reduces the level of external stimulation to a minimum, including the impact of gravity. This is typically achieved through a fibreglass tank, large enough for one person to lie in comfortably, while having enough space to move. The tank is filled with water warmed to skin temperature (34.7 degrees Celsius) to reduce tactile experience. The water is saturated with Epsom salts (Mg_2SO_4) which produces a solution that allows the user to supinely float with their face and ventral portion of the body above the water-line. Due to the density of the salt-water solution, it is impossible to accidentally turn over. The tank is typically shaped as a large box or bathtub with a spacious top that can be closed. This leaves the enclosure dark and almost soundproof (< 10db). The opening and closing of the lid can be operated from the inside, enabling the user to leave at any desired moment.

Being soundproof, floatation-REST is a quiet environment, a condition necessary for eliciting the relaxation response (Wallace & Benson, 1972). Ben-Menachem (1977; as cited by Bood, 2007) goes further than Benson, claiming that reduced sensory stimulation in general is important for the relaxation response. Clearly floatation- floatation-REST, having been invented to reduce sensory stimulation to the greatest level possible, fulfils this requirement. By floating effortlessly in a supine position, with clear breathing channels, floatation-REST also fulfils Benson's requirement of “a comfortable position” (Wallace & Benson, p. 60). Indeed, self-reports have indicated that the vast majority of participants experience deep relaxation during floatation-REST (Turner & Fine, 1993), implying that users of floatation-REST feel 'comfortable' during sessions. Ben-Menachem has added “reduced bodily movement” as a further condition for eliciting Benson's relaxation response (Ben-Menachem, 1977; as cited by: Bood, 2007, p. 12). Given that the user of floatation-REST is floating comfortably in a small,

enclosed space, the reduction of bodily movement is encouraged. By fulfilling these requirements floatation-REST offers an environment that may be capable of eliciting the relaxation response, and thus, potentially mindfulness.

The Relaxation Response and Floatation-REST

The relaxation response is partially characterized by a decrease in blood pressure (BP). A decrease in systolic and diastolic BP associated with floatation-REST has been found in several studies (Bood, Sundequist, Kjellgren, Nordstrom & Norlander, 2007; Caramano et al., 2015; Turner, Fine, Ewy, Sershon & Freundlich, 1989; Turner, Fine, McGrady & Higgins, 1987). This suggests floatation-REST is evoking the relaxation response, which is one mechanism associated with mindfulness.

.....One study with 21 participants measured the impact of floatation-REST on mean arterial pressure (MAP) (Turner, Fine, Ewy, Sershon & Freundlich, 1989). MAP is calculated by a combination of systolic and diastolic BP. The authors hypothesised that the presence of light during floatation-REST would diminish relaxation due to the increase of sensory stimulation. While this hypothesis was not supported by the evidence, the results displayed important information on floatation-REST's association BP. The participants were paired by baseline cortisol levels into two groups: floatation-REST with light; and floatation-REST without light, before entering into a three-phase design procedure. This procedure will be discussed in more detail latterly. The authors found significant decreases in MAP for each condition. Floatation-REST with light: Baseline ($M = 89.4$, $SD = 1.76$), Treatment ($M = 81.11$, $SD = 1.89$, $p < 0.001$); floatation-REST without light: Baseline ($M = 90.44$, $SD = 1.64$), Treatment ($M = 80.54$, $SD = 1.26$, $p < 0.005$). Thus, the presence of light within floatation-REST did not impact the relaxation process in these young participants, as measured by MAP. While light did not appear to affect relaxation, it is too early to draw conclusions over whether the absence of light (and thus greater reduction of external stimulation) is necessary for the relaxation effects of floatation-REST. As the authors recognized, darkness is one of the most common fears of novices to floatation-REST. It may be that this study found the fear associated with darkness removed for those in the light-present

condition, allowing their BP levels to decrease, despite having more external stimulation present. It is possible that this fear is only present during the beginning stages of using floatation-REST, as the participant is orienting to the environment. To investigate this matter more thoroughly future research could explore the impact of the presence of light on experienced users of floatation-REST. The results are limited by there being no control group (this was unnecessary for the authors' hypothesis), and the generalizability of the results is restricted to young adults, given the participant pool.

Turner, Fine, McGrady & Higgins (1987) measured the impact of floatation-REST on BP in both hypertensive and normotensive participants. The authors randomly assigned 21 hypertensive participants and 13 normotensive participants to a floatation-REST or biofeedback group. Biofeedback is a process where electronic monitoring of a typically automatic bodily function (i.e. heart rate) is used to train someone to acquire voluntary control of that function (Gartha, 1976). After participant withdrawal there were 12 in the floatation-REST group and 18 in the biofeedback group. After a six week, treatment-free baseline, participants received 20 sessions of their allocated treatment, for 50-60 minutes over a 10 week period. Both groups listened to autogenic training tapes during their sessions. Autogenic training is a form of relaxation therapy that involves autosuggestions which instruct the listener to relax and control breathing, blood pressure, heartbeat, and body temperature (Schultz & Luthe, 1959). Thus, the study was investigating floatation-REST-assisted relaxation training, as opposed to pure floatation-REST. Two-way ANOVA with repeated measures found significant differences for both systolic and diastolic blood pressure in hypertensive participants between baseline levels and floatation-REST post-treatment levels. Systolic: ($F = 9.5$, $df = 1.16$, $p < 0.01$); Diastolic ($F = 39.5$, $df = 1.16$, $p < 0.01$). Biofeedback hypertensive participants showed clinically significant and equivalent results. No significant difference was found for BP in normotensive participants in either condition. For investigating the impact of floatation-REST on BP this study is limited by not exploring the impact of floatation-REST alone. It may be that the results were produced by an interaction effect of autogenic training and floatation-REST. Further limiting the results of this study is the small participant numbers, having dropped from 18 at initial recruitment to 12 by treatment time. Within these

limitations, this study does indicate that floatation-REST-assisted autogenic training has a significant positive impact on blood pressure in normotensives, that is comparable to biofeedback-assisted relaxation training.

In a more recent study, Bood, Sundequist, Kjellgren, Nordstrom & Norlander (2007) investigated whether 33 floatation sessions had a greater impact on blood pressure (BP) for participants with stress-related ailments. 37 participants (29 women and 8 men) all diagnosed with a stress-related pain of a muscle-tension type were recruited for the study. The participants had an average age of 49.54 and 18 had been diagnosed with burnout depression. They were randomized into one of two conditions: 12 floatation-REST sessions (which had 7 burnout participants; or 33 floatation-REST sessions (11 burnout participants). The experiment consisted of two floatation-REST sessions per week, and then a week break, with 12 treatments over seven weeks, for both groups. After this point the participants in the 33 floatation-REST group went through seven more three week cycles, but decreasing to one floatation session per week. Three-way split-plot ANOVAs found a significant Tests x Treatment interaction effect ($F(1,33) = 4.64, p = 0.039$). Further analysis (pair-sampled t tests) showed no significant difference for diastolic blood pressure after 12 sessions. However, there was a significant effect on diastolic BP after 33 treatments of floatation-REST: (before: $M = 83.32, SD = 12.27$; after: $M = 78.78, SD = 9.79, p < 0.05$). There were no significant results found for systolic BP after either 12 or 33 sessions of floatation-REST. Thus, the results of the study indicate that floatation-REST can have a significant healthy impact on diastolic BP for participants with stress-related ailments of a muscle-tension type. The results also show that 33 sessions may be a more suitable number for producing relaxation (as measured through BP) in those with stress-related, muscle-tension based grievances. The results of this study are limited by the inclusion of participants with burn-out depression. The generalizability of the results is restricted to participants with stress-related ailments. Participants without such ailments may receive greater decreases in BP levels after a smaller number of floatation-REST sessions. Further limiting the generalizability is the absence of a control group, although this was not necessary for the testing of the authors' hypothesis.

Caromano et al. (2015) did find a significant decrease in systolic and diastolic BP after 12 sessions of a modified version of floatation-REST, in healthy participants. Twenty-one healthy women were recruited into an experimental design that featured 12 sessions of modified REST (mREST), for 15 minutes, twice a week over six weeks. mREST is an adapted form of REST, proposed by da Cunha & Caramano (2006) as a less expensive and more accessible alternative to floatation-REST. It involves immersing the participant in a regular swimming pool, positioned with the head constantly out of water through the use of floatation equipment. Visual and auditory stimuli are restricted with a blindfold and earplugs, with the water temperature at 34 degrees Celsius. A physiotherapist stands next to the participant and they can stop the session if necessary. In Caramano et al.'s (2015) study, the physiotherapist was 50cm away from the participant. Systolic and Diastolic BP were measured before and after each session. ANOVA and Tukey post-hoc tests found post-intervention results to be lower than pre-intervention results for every session for systolic BP ($p < 0.001$), and lower for diastolic BP on sessions 1-3, 5 & 11 ($p < 0.005$). Pre-intervention results for systolic BP were significantly lower than pre-intervention levels at session 1 for sessions 3-12 ($p < 0.001$). Pre-intervention results for diastolic BP were significantly lower at session 4-12 than pre-intervention levels at session 1 ($p < 0.005$). These results indicate a possible accumulatory effect: mREST may have been inducing decreases of BP outside of the treatment sessions themselves. Systolic BP post-intervention results were also significantly lower than post-intervention results after session one, for sessions 3-12 ($p < 0.001$). Diastolic BP post-intervention levels were significantly lower at sessions 11 and 12 than session 1 ($p < 0.005$). These results showed that 12 sessions of mREST were enough to impact significant differences in BP in healthy participants. The decrease in pre-intervention systolic and diastolic BP during the treatment, compared with levels before the first session were have been interpreted as suggesting an accumulatory effect of mREST treatment (Caramano et al). While this is a possible explanation, another possibility is that participants may have been more familiar with the environment and the measuring procedure after the initial testing, thus leaving them more relaxed and consequentially having lower BP. With the lack of control group this possibility cannot be removed. mREST as a procedure itself, has its

own limitations. The creators (da Cunha & Caramano, 2006) proposed this technique due to it being “relatively practical, inexpensive and accessible compared to the original version” (Caramano et al., 2006, p. 2). However, it is unclear whether mREST would be more practical, inexpensive and accessible for the wider population. Firstly, a thermoneutral pool would need to be cleared of other people for the sole user, ensuring the water was not disturbed during their session of restricted stimulation. Secondly, it is probable they would need to pay the physiotherapist to be present. mREST may be more feasible for a short-term experimental environment, but it is uncertain whether it is as beneficial for the wider population. Another consideration and potential limitation is whether the state of the physiotherapists physiological activation impacts the participants ability to relax in mREST. If mREST is to continue being used as an affordable, alternative research tool for floatation-REST it would be beneficial for future studies to show that they produce similar results. The generalizability of this study is limited to young, females, as these were the only participants used.

In summary, the research reviewed shows that floatation-REST appears to induce the relaxation response, as measured through significant decreases in blood pressure. The research investigated utilizes different session durations over varying periods of time with varying results on what is effective for which populations. To further understanding in this area future research needs to be using control groups and larger sample sizes. Furthermore, future studies investigating the impact of floatation-REST should utilize floatation-REST, until clear evidence has been provided to show that modified-REST is a suitable alternative for gathering floatation-REST results.

Cortisol and Floatation-REST

The physiological reduction of stress is often measured by cortisol levels (Moraska, Pollini, Boulanger, Brooks, & Teitlebaum, 2010) as the stress response is facilitated by the release of cortisol (Cahn & Polich, 2006). The relaxation response is the physiological opposite of the stress response, thus an indicator of this response is the alteration of cortisol levels. Cortisol levels have been shown to decrease in association with the use of Floatation-REST (Turner and Fine, 1983; Turner, Fine, Ewy,

Sershon & Freundlich, 1989; Turner, Fine, McGrady & Higgins, 1987) and this effect has been maintained after the cessation of repeated floatation-REST sessions (Turner & Fine, 1993).

Turner, Fine, Ewy, Sershon & Freundlich (1989) also measured the impact of floatation-REST (with or without light) on cortisol levels, atop of blood pressure (BP). The study utilized young participants (22-28 years) with a larger pool of males to females (15 and 6, respectively). The 21 participants were paired by baseline cortisol levels into two groups: floatation-REST with light; and floatation-REST without light, before entering into a three-phase design procedure. Baseline (phase one) had bi-weekly cortisol measures and no floatation-REST sessions. Phase two consisted of two weeks of two floatation-REST sessions per week, with 2-3 days break between. Phase three consisted of two weeks of two floatation-REST sessions again, with cortisol levels taken between floats, on non-floating days. All cortisol measurements were taken between 1200 and 1400 hours, twice, with 20 minutes between. Results found cortisol levels to significantly reduce for both groups after floatation-REST treatment: Light group (Baseline: $M = 14.95$, $SD = 0.52$) (Treatment: $M = 11.72$, $SD = 0.41$, $p < .01$); Non-light group (Baseline: $M = 16.58$, $SD = 0.54$) (Treatment: $M = 13.78$, $SD = 0.51$, $p < .05$). The results indicate a clear decrease in cortisol levels in association with floatation-REST, in a reasonably-sized pool of young participants. Although, the study is limited by not having a control group.

Turner, Fine, McGrady & Higgins (1987), similarly measured the impact of floatation-REST on BP, as well as cortisol. The authors used both hypertensive and normotensive participants, while comparing floatation-REST in conjunction with autogenic training to biofeedback with autogenic training. A more detailed account of their study design was discussed earlier. Thus the study was investigating floatation-REST-assisted relaxation training, as opposed to pure floatation-REST. Cortisol measurements were taken during baseline and during the last week of the treatment period. Cortisol levels were measured between 1200 and 1400, with two samples taken 20 minutes apart. The authors stated post-treatment results showed significant decreases for both hypertensives and normotensives. Specific statistics were not supplied, but the reading of graphs supplied by Turner, Fine, McGrady and Higgins (1987) offered the following approximate results for plasma cortisol for the floatation-REST group: Hypertensives

Baseline: $M = 16.4$, Post-Treatment: $M = 11.2$; Normotensives Baseline: $M = 14.2$, Post-Treatment: $M = 10.01$. Compared to the Biofeedback group: Hypertensives Baseline: $M = 15.5$, Post-treatment: $M = 14.5$; Normotensives Baseline: $M = 13.8$, Post-treatment: $M = 11.4$. Graphs displaying urinary cortisol results showed large, face-value differences between the groups: Hypertensives Baseline: $M = 75$, Post-treatment: $M = 42$; Normotensives Baseline: $M = 71$, Post-Treatment: $M = 53$. Compared with the Biofeedback group: Hypertensives Baseline: $M = 58$, Post-Treatment: $M = 49$; Normotensives Baseline: $M = 51$; Post-treatment: $M = 58$. The floatation-REST group were reported to have more consistent cortisol changes, with decreases in 83% of participants, compared to 33% in the biofeedback group. The authors interpreted these results as indicating floatation-REST's potential greater potency as a mediator of the relaxation response than biofeedback. Indeed, the results do show an alteration in cortisol levels and is supportive of the idea that floatation-REST-assisted relaxation training is associated with stress reduction. The results are limited by the implementation of autogenic training in both conditions. While the authors concluded that since autogenic training was in both conditions, it was controlled for. Thus, the differences between the groups was caused by floatation-REST itself. However, it may be that an interaction between autogenic training and floatation-REST was responsible for the results. The results are further limited by small participant numbers, which dropped from 18 to 12 by treatment time.

A study by Turner and Fine (1983) also investigated the impact of floatation-REST assisted relaxation on cortisol. With small participant numbers the investigators randomly assigned 12 participants to one of two treatments: a floatation-REST assisted relaxation programme; or a similar relaxation programme without floatation-REST. Each group experienced two baseline sessions (1 day in between) where they quietly reclined in a chair for 30 minutes. Average cortisol levels from baseline were used in analyses. Four days later the groups experienced their differing treatments. The relaxation paradigm consisted of the participants being in darkness with a recording playing the phrase “my arms and legs are heavy and warm” for 90 seconds. A dim light was then turned on and participants were instructed to allow their thoughts to flow without special focus for 60 seconds, before the lights were

dimmed and the audio was repeated for 90 seconds. This cycle continued 10 times. The difference between the treatment groups was in the environments where the relaxation paradigm was experienced. The floatation-REST group were in floatation-REST, while the non-REST group were reclined in a reclining chair in a room with little noise (< 30dB). Pre and post session cortisol levels were taken. Four or five days after the treatment period each group went through two follow up sessions. During follow-up each group returned to the reclining chair and listened to the audio cycle for 35 minutes. There were no significant differences between the groups at baseline. Pre and post session changes within the treatment period were pooled and averages for each group were calculated. Results showed a significant decrease in cortisol levels for the floatation-REST group compared to the non-REST group. Non-REST: Pre-session ($M = 13.3$, $SD = 1.8$), post-session ($M = 11.8$, $SD = 1.8$); floatation-REST: Pre-session ($M = 11.9$, $SD = .7$), post-session ($M = 9.3$, $SD = .5$, $p < .05$). The difference between the groups had a large effect size (Cohen's $d = 8.7$). At follow-up cortisol levels were still significantly lower for the floatation-REST group than those in the non-REST condition: Non-REST: pre-session ($M = 14.6$, $SD = 2.0$), post-session ($M = 13.8$, $SD = 2.3$); floatation-REST: pre-session ($M = 12.1$, $SD = 1.5$), post-session ($M = 11.1$, $SD = 1.2$, $p < .05$). The floatation-REST groups averages at follow-up were also significantly lower compared to their baseline results ($p < 0.05$): pre-session ($M = 12.9$, $SD = 1.0$), post-session ($M = 13.6$, $SD = 1.1$). The results from this study indicate that the floatation-REST effect on cortisol may be due to more than the use of the relaxation procedure alone, since the participants exposed to a similar paradigm (minus floatation-REST) showed no change. The decrease in cortisol levels suggest that floatation-REST is associated with a decrease in adrenal-axis activity. The results gathered at follow-up, which was 4-5 days after floatation-REST treatment, suggest that floatation-REST may be inducing a carry-over effect on the regulation of cortisol. The participants used in Turner and Fine's (1983) study do limit their results. Participant numbers were low, with only 12 participants in total (six in each group). The generalizability of the results is also impeded by the sole use of young males. Another factor to consider is that, since a relaxation paradigm was used in conjunction with floatation-REST,

the results may not be indicative of floatation-REST alone. The alteration in cortisol levels may have been the result of an interaction between floatation-REST and the relaxation paradigm.

The preceding studies show a decrease in cortisol levels associated with floatation-REST (Turner & Fine, 1983; Turner, Fine, Ewy, Sershon & Freundlich, 1989; Turner, Fine McGrady & Higgins, 1987). However, they are all limited by measuring cortisol via methods that are no longer considered best practice, as well as investigating cortisol levels with the contested assumption that decreases are always positive (O'Leary, O'Neill & Dockray, 2015). These results do indicate floatation-REST having an impact on cortisol. This provides additional evidence that floatation-REST may be providing physiological stress reduction through the evocation of the relaxation response, one of the mechanisms of mindfulness. However, it would be of great benefit for future research to investigate the impact of floatation-REST on cortisol with: larger participant numbers; participants from a wider variety of age groups; the use of floatation-REST alone, as well as testing whether floatation-REST in conjunction with other relaxation techniques produces an interactive effect; the use of control groups; measurements of cortisol through CAR (Chida & Steptoe, 2009); consideration and documentation for which days of the week levels are measured on, since week-days and weekends elicit different responses (Mikolajczak et al., 2010); as well as the understanding that flexibility of cortisol may be more indicative of healthy cortisol levels, than decreases alone (Mikolajczak et al., 2010).

Attention and Cognition in Floatation-REST: Theories and Self-Reports

One of the prominent theories for the actions of floatation-REST (Turner & Fine, 1993) can be mapped onto mindfulness theory. This further suggesting that floatation-REST may elicit a state of mindfulness. Turner and Fine (1993) propose that at a given moment “an individual exists physiologically in a state ranging from physiology UP to physiology DOWN and from Attention External to Attention Internal (to self)” (p. 221). Turner and Fine's (1993) *physiology up* relates to the stress response, which is facilitated by the release of cortisol and is related to increased levels of blood pressure. The authors' *physiology down*, by contrast, relates to Benson's relaxation response (Wallace

& Benson, 1972). This is associated with decreased blood pressure and alterations in cortisol. The authors postulate that, due to the reduced external input, the situation in floatation-REST is physiology down and attention internal. Turner & Fine (1993) note that this extreme degree of input reduction offers the opportunity for unhindered self-attention. Similarly, in the beginning stages of learning to elicit the state of mindfulness it is helpful to be in a quiet environment. Mindfulness meditation typically occurs with the eyes closed, and emphasis is placed on remaining aware of internal sensations, emotions and thoughts, rather than focusing externally. This is parallel to the reason Buddhists build meditation halls and monasteries: to create a physical environment free of distractions (Gunaratana, 1996). Turner and Fine (1993) continue their theory by suggesting that a cognitive feedback loop for appraisal of the experience is included in the process. The authors discuss that if this appraisal “moves towards ACCEPTANCE, the [floatation-]REST experience will achieve maximum potential. If appraisal moves towards REJECTION, the [floatation-]REST experience will be hindered” (p. 221). They hypothesize that repetitive exposure to floatation-REST facilitates the movement of appraisal towards acceptance (Turner & Fine, 1993). Research and theory indicate that mindfulness subsumes an acceptance of experience (Brown & Ryan, 2003). And intentionally created acceptance can be helpful in the development of mindfulness in the beginning stages of Mindfulness training (Chiesa, 2012). Mapping mindfulness onto Turner & Fine's theory, if users either intentionally evoke acceptance, or are simply resting in a state of mindfulness that subsumes acceptance, floatation-REST will be able to achieve its maximum potential, because the mechanism that floatation-REST works through, or is facilitated by, is mindfulness. Conversely, when participants are not in a state mindfulness (which subsumes an acceptance of the present-moment experience), the floatation-REST experience is hindered. Mindfulness' relationship with acceptance has been discussed in more detail previously. Having an appraisal of “acceptance” (Turner & Fine, 1993, p. 221) also fulfils Benson's “passive attitude” requirement of the relaxation response (Wallace & Benson, 1972), one of the mechanisms that mindfulness works through.

Turner & Fine (1993) offer earlier research as evidential support of their theory (Turner & Fine, 1985; as cited by: Turner & Fine, 1993). The authors divided repressive and non-repressive participants (based on their coping style) into a floatation-REST group or relaxation control (Turner & Fine, 1985; as cited by: Turner & Fine, 1993). Repressors were defined as “individuals who reported experiencing little distress in everyday situations and are inaccurate in their perceptions (i.e. are deceiving themselves, using a repressive coping style)” (Schwartz, 1990; as cited by: Turner & Fine, 1983, p. 221). The authors theorized that repressive participants would not only be less aware of self-processes (i.e. heart rate), but would also be less able to control them due to the detraction of active repression (Turner & Fine, 1985; as cited by: Turner & Fine, 1993). The results found the participants in the floatation-REST condition were able to increase and decrease their heart rate to a higher (or lower) level than in the relaxation control condition. The maximum change of heart rate was also greater and the time taken to reach maximum change was shorter in floatation-REST than the control group. The authors interpreted these results as demonstrating heightened self-attention, in floatation-REST compared to the control, which supports their theory. Interestingly, in the floatation-REST condition the repressors performed like the non-repressors. Turner and Fine (1985; as cited by: Turner & Fine, 1993) suggest that floatation-REST may interrupt the normal repressive coping style, whereby repressors become less repressive in floatation-REST. This phenomenon can also be interpreted as floatation-REST inducing a state of mindfulness, which is antithetical to the act of repression. Repression is a form of response modulation which is responsible for the diminishing of one's emotional responses (Chambers et al., 2009). Mindfulness, by contrast, involves an increasing awareness of these, as well as an abstaining from repression or any other form of emotional alteration (Chambers et al., 2009). Thus, the participants in the floatation-REST condition may have entered into a state of mindfulness where they were simultaneously more aware of their experience and not altering it in any way (i.e. repressing it), which allowed the repressive participants to enhance their awareness of and ability in activities linked to self-awareness (i.e. heart rate).

Some authors have focused on floatation-REST's capacity to induce primary processing (Bood, 2007; Norlander, Bergman & Archer, 1998). Norlander (1997) has proposed that both floatation-REST and meditation are amongst the techniques that facilitate a shift between primary and secondary processing. Primary processing is associated with free-associative and analogical thinking, reverie and 'day-dreaming' (Norlander, Bergman & Archer). Secondary processing, by contrast, involves the logical, problem-solving thought (Norlander, Bergman & Archer, 1998). A study by Norlander, Bergman & Archer (1998) found results that were interpreted as floatation-REST facilitating primary processing. The study design consisted of two experiments. During the first experiment 40 participants were randomly assigned to a control group or a floatation-REST group. Both groups were set the same problem-solving task for five minutes before a 45-minute recline in a chair reading magazines (control group), or a 45-minute floatation-REST session, before returning to the task for half an hour. Participants who completed the task before the treatment were removed from the study. Results showed that participants in the floatation group required more time than the control group to complete the task. A two-way ANOVA found a significant difference between the groups ($F(1,30) = 4.75, p < 0.04$), floatation-REST group ($M = 27.07, SD = 6.08$), control group ($M = 21.00, SD = 10.16$). The authors suggested this result indicates that floatation-REST may be causing a residual effect, where primary process is still dominating over the secondary process, as problem-solving may be connected to secondary processing (Norlander, Bergman & Archer, 1998). The second experiment had 54 participants randomly assigned to three groups: A control group (who sat on an armchair and read magazines); a dry-REST group (who lay on a bed in a dark room); and a floatation-REST group. After 4 acclimatizing treatment sessions (45-minutes in length), all participants completed a task after the fifth treatment. Each participant was asked to produce as many consequences as possible to six dramatic events. A panel of judges (consisting of two high school teachers) was formed to assess responses as being either obvious or original. Univariate F tests showed a significant difference between groups ($F(2,48) = 4.11, p < 0.02$). A post-hoc test showed that the floatation-REST group ($M = 8.53, SD = 3.48$) had higher scores on originality compared to non-REST ($M = 5.6, SD = 3.01$), but not to dry-

REST ($M = 7.33$, $SD = 2.57$). Norlander et al. (1998) connected the higher scores of originality to primary processing, proposing the results as further evidence for floatation-REST facilitating a shift into that mode of processing. If it is the case that movements in primary and secondary processing are demonstrating shifts in conscious, preconscious and unconscious processes, and that these shifts are facilitated by both floatation-REST and meditation, then this theory and Norlander et al.'s (1998) results are important for demonstrating that mindfulness may be involved with both techniques.

Reports of the phenomena participants attend to during floatation-REST are also aligned with how attention and awareness are used in mindfulness. Caramano et al. (2015) documented that participants submitted to floatation-REST report heightened awareness of internal sensations. Bood (2007) notes that attention is “oriented towards the 'here and now'... [and] the bodily sensations from the internal organs and from the vestibular system as well as the tactile and kinaesthetic senses appear” (p. 21). This style of attending that has been reported during REST is akin to mindfulness.

Literature Summary

To refresh, mindfulness is defined as being aware of and attentive to internal and external phenomena as they arise in the present moment (Brown & Ryan, 2004; Mikulas, 2015). Mindfulness is considered a faculty of consciousness both within Buddhism, where the concept of mindfulness hails from, and modern psychology. Typically mindfulness is developed by meditation. Meditation can be divided into two main forms: concentrative and mindfulness. Both forms incorporate varying levels of the other. Mindfulness meditation is a practice of intentionally entering into and returning to a mindful state of consciousness for a particular period of time. Dispositional mindfulness, by contrast, is the extent to which individuals tend towards awareness and sustained attention to what is presently occurring, in the context of their everyday lives (Brown & Ryan, 2003). It is widely held that time spent in Mindfulness meditation increases levels of mindfulness, which in turn improves psychological functioning. This belief has been gaining empirical support (Carmody & Baer, 2008). Over the past three decades mindfulness has been associated with a wide array of psychological improvements

(changes?) and is now considered part of the third wave of behavioural therapies. While research into how mindfulness works is a relatively young area of inquiry, a number of mechanisms have been associated with mindfulness's impacts: the relaxation response (and the associated decreases in blood pressure and alterations in cortisol); a reduction in the default mode network (a network associated with mind-wandering); a change in attentional resources; and the enhancement of emotional regulation.

Mindfulness meditation, however, is not the only practice that can enhance levels of dispositional mindfulness. Floatation-REST may be another tool for evoking a state of mindfulness and thus enhance dispositional levels of this faculty of consciousness. As the most sensory reduced environment available which participants can use comfortably, floatation-REST is ideal for inducing mindfulness (Wallace & Benson, 1972). Decreases in blood pressure and alterations in cortisol levels are physiological indicators that floatation-REST is producing a relaxation response, one of the mechanisms associated with mindfulness. Self-reports on thinking styles and stimuli attending indicate an orientation towards the present-moment in floatation-REST, which are the attending styles that mindfulness is theorized to make possible. Furthermore, one of the prominent theories of the mechanisms of floatation-REST can be mapped onto the theory of mindfulness. These various pieces of evidence suggest that floatation-REST may indeed, evoke a state of mindfulness.

Introduction to the Present Research

Given that floatation-REST appears to be an ideal environment for evoking mindfulness it is plausible that intentionally engaging in Mindfulness during floatation-REST will increase trait mindfulness levels beyond those reached in a normal sensory environment. This reasoning leads to the first hypothesis of the current study:

H1. Time spent meditating in floatation-REST will significantly increase mindfulness levels in beginning meditators, compared to those who are solely meditating in a normal sensory environment.

It is unclear what impact meditation in floatation-REST will have on an individual's willingness to engage in meditation in a normal sensory environment. Experience with floatation-REST may present the individual with the benefits of meditation earlier in their practice and thus encourage the individual to meditate more, regardless of the environment. Conversely, the meditator may be satisfied with the benefits garnered from meditation in floatation-REST alone and their inclination to engage in the practice outside of this environment may decrease. This speculation leads to the second hypothesis of the current study:

H2. Floatation-REST will affect an individual's time spent meditating in a normal sensory environment. However, the direction of this impact is currently ambiguous.

To test these hypotheses, participants were trained in a mindfulness-based meditation technique before engaging in seven fortnightly floatation-REST or group meditation sessions, for one hour. Participants engaged in individual meditation in between sessions, which were recorded on meditation logs. Mindfulness levels were recorded fortnightly to measure the changes for participants over the duration of the study.

Method

Participants

Fifty university students and community adults, comprising 27 males and 23 females, ranging from 18 to 63 years ($M = 28$, $SD = 11.06$). All participants volunteered to be involved in the study. 25 participants were randomly allocated to each of the Floatation and Control groups. Five participants withdrew during the research. This left 25 males and 20 females, ranging from 18 to 63 years ($M = 27$, $SD = 11.20$), with 23 participants in the Floatation group and 22 in the Control group.

Participants were required to be over the age of 18. No participants with epilepsy, over two months pregnant, hair dyed any colour other than blonde or brown, with dreadlocked hair, or those who had previously learnt a meditation technique were included in this study. The majority of these restrictions were to avoid complications with the use of the floatation tank, while the last restriction was to ensure participants were novice meditators.

Participants were offered at least three hour-long sessions in floatation-REST for participating in the study. The participants in the Control group were offered these sessions post-research, while the participants in the Floatation group received them during the study. Informed consent was obtained from all (see Appendix B).

Apparatus

Floatation-REST (Restricted Environmental Stimulation Technique)

A floatation tank measuring 2700 mm \times 1500 mm \times 1300 mm was utilized for the research. The depth of the solution (saline water) varied between 200 and 300 mm. The floatation tank was insulated to maintain constant air and water temperature and to reduce incoming light and noise. The water temperature was maintained at 34.7°C and was saturated with magnesium sulfate (MgSO_4 , Density: 1.3 g/cm³). The tank was equipped with an entrance door that was able to be opened and closed (internally and externally) by the participant. The filtration process utilized Hydrogen Peroxide (H_2O_2) and all the water was recycled at least three times between each participant's visit.

Showering immediately before and after use of the tank was required for the maintenance of hygiene. Body wash, facial wash, shampoo, conditioner and towels were supplied. For the walk from the shower to the floatation tank participants were provided with a clean bathrobe and slippers. Ear plugs and a facecloth were also made available for use in the tank.

Materials

Demographics Questionnaire

The demographics questionnaire gathered information on the participants' age, gender, employment status, whether the participant considered him or herself spiritual, their religious affiliation, as well as the aspect that attracted the individual to participate in the research (learning meditation, use of floatation-REST or both) (see Appendix D).

Mindfulness Attention Awareness Scale (MAAS)

Brown & Ryan, 2003. This 15-item scale measures the frequency of mindful states in day-to-day life, using both general and situation-specific statements. Examples of these questions range from: I could be experiencing some emotion and not be conscious of it until sometime later; I tend to not notice feelings of physical tension or discomfort until they really grab my attention; It seems I am "running on automatic", without much awareness of what I'm doing.

Item MAAS scores range from 1 to 6 (where 1 = almost always, 2 = very frequently, 3 = somewhat frequently, 4 = somewhat infrequently, 5 = very infrequently, 6 = almost never. Higher scores are thus indicative of higher levels of mindfulness. The total score for the questionnaire is calculated by the total of individual answers divided by the total number of questions (15) (see Appendix E). The MAAS has demonstrated high test-retest reliability, discriminant and convergent validity, known-groups validity, and criterion validity. Internal consistency levels (Cronbach's alpha) generally range from .80 to .90 (Brown & Ryan, 2003; Carlson & Brown, 2005). Correlational, quasi-experimental, and experimental studies indicate that the trait MAAS taps a unique quality of consciousness that is related to, and

predictive of, a variety of emotion regulation, behavior regulation, interpersonal, and well-being phenomena (Brown, 2008).

Cronbach's alphas for the present research were high, ranging from .764 to .852. These were taken from the first MAAS completed (initial baseline) and second MAAS (second baseline), respectively.

The MAAS was distributed and completed on paper for the first two baseline questionnaires. It was later distributed and completed electronically via Qualtrics.

Meditation Logs

Meditation logs were created for participants to record the length of their meditation each day of the experiment; what (if any) difficulties arose during meditation; their reasoning for not meditating for the intended length of time (if applicable); and if a participant did not meditate on a particular day, their reason for not doing so. The meditation logs were personalized, with each participants name typed on it for ease of identification when handing in to the researcher. The days of the participant's floatation session or group meditation were included (see Appendix H).

Rating Scale: Preference for Individual or Group Meditation

A 10-point Rating Scale was constructed to explore whether participants found individual or group meditation easier. This inquiry was posed to participants as, 'How have you found meditating in a group in comparison to meditating on your own?'. Available answer options ranged from '0 – Significantly harder, 5 – About the same, 10 – Significantly easier' - making a high score indicative of preference for group meditation over individual meditation (see Appendix F).

Rating Scale: Willingness to use Floatation-REST or join a Group Meditation Post-Research

A 10-point rating scale was constructed to determine participants' willingness to engage in an hour-long group meditation or floatation-REST session (depending on the group assigned to), once the research was complete. The appropriate groups were asked 'would you engage in a one-hour group

meditation/session in floatation-REST again?’ and presented with the following answer options: 0 – I definitely would not, 5 – I’m unsure, 10 – I definitely would (see Appendix G).

Meditation Training

An independent meditation teacher recruited for the experiment taught a mindfulness-based meditation technique over 5 sessions. Participants were offered the choice of meditating while seated on the floor (with a 3-6 inch cushion placed under the buttocks) or on a chair (which had a straight back and enabled feet to be flat on the floor). An erect, yet relaxed posture was requested, with the head, neck and back vertically aligned.

Once seated, participants were asked to focus their awareness internally - to the different thoughts, physical sensations, emotions and the reception of any external stimulation via their senses. The teacher instructed participants not to engage with any aspect of their experience, but to simply observe it. Participants were to practice being completely receptive to whatever entered their field of awareness, to allow it to arise and dissipate of its own nature, while they sat and witnessed these experiences unfold.

The initial 5-hour lesson consisted of a series of 20-minute meditations, with time allowed for questions, feedback, discussion and lunch in between. The length of individual meditation sessions increased to 30-minute intervals in the following four lessons. The length of the consecutive four lessons were 2.5 hours, 5 hours, 2.5 hours, and 5 hours, respectively (see Appendix C).

During the first lesson participants were instructed to engage in a 30-minute individual meditation daily, for the entirety of the project – excluding the days that a lesson, group meditation, or floatation-REST session was scheduled. Meditation logs were to be filled in on a daily basis where participants were to note if they completed the intended 30-minute meditation. If so, they were asked to document if any difficulties arose while sitting and of what nature. If participants only meditated for part of the intended length they were asked to note why this was the case and for how long they sat. If participants did not meditate they were asked for the reason that prevented them from doing

so. Instructions on the meditation logs requested those in the Control group to hand their completed logs in to the researcher at the next group meditation and those in the Floatation group to return them at their next floatation-REST appointment.

Procedure

Approval to conduct the research was obtained by the University of Canterbury Human Ethics Committee (see Appendix A). Additionally, all individuals wishing to take place in the study gave their informed consent before the study commenced (see Appendix B).

Participants were randomly allocated to the Control group or Floatation group, prior to the meditation lessons that all participants received. Measures were taken throughout the research to prevent either group discovering the division between participants. The Floatation group were contacted individually and requested to not comment on nor question the use of the floatation tank during the group meditation lessons. This appeal was explained as a need to focus the lessons on the concept of meditation alone, so as to not distract from learning. If there were any queries around the use of the floatation tank, participants were asked to email the researcher.

All participants were asked to commit to a 16-week experimental period. This included initial attendance of 5 compulsory meditation lessons, over the space of two weeks. These lessons consisted of three 5-hour sessions and two 2.5-hour evening sessions. Participants were requested to bring a drink bottle, a pen for completing questionnaires, a pillow for sitting, and a vegetarian plate to share for lunch during the three 5-hour sessions.

The first baseline MAAS and demographics questionnaire were administered on paper and completed by pen upon arrival at the opening lesson, prior to the commencement of teaching. The second baseline MAAS was distributed and completed at the beginning of the final meditation lesson. From this point the MAAS was converted to an electronic format and emailed to participants on a fortnightly basis. Participants were allowed three days to complete the MAAS before the questionnaire was deactivated. Nine MAAS questionnaires were distributed

throughout the duration of the research including the preliminary two used as baseline measures. The final MAAS was completed after the last group meditation and final floatation-REST session for each participant (see Appendix C)

The Rating-scale measuring participants' preference for individual or group meditation was dispensed at the last meditation lesson, alongside the second MAAS baseline. This 10-point scale was distributed and completed by pen and paper and returned to the researcher before the final meditation lesson commenced. The addition of this Rating-scale was prompted by several participants giving feedback during earlier meditation lessons, noting how much easier they found meditation in a group compared to individually. This addition was an amendment to the original procedure.

Floatation Group

Participants in the Floatation group were organized to attend 7 one-hour sessions in floatation-REST, on a fortnightly basis. Session times were arranged via the online meeting scheduler, 'Doodle'. Participants maintained the same session time and day on a fortnightly rotation and received a reminder text the day before their appointment. Sessions commenced the day following the final meditation lesson.

The floatation tank was situated at a private property, near the University of Canterbury campus. Participants were invited to bring a friend or whanua member along to their floatation-REST appointment. In the case of a participant not bringing a support person, the researcher provided a third person. This third person was present during all participant/researcher interactions, to ensure the safety of the participant.

The researcher instructed participants how to use the floatation tank before showering for their initial floatation-REST session. Instructions included putting earplugs in before entering the tank, how to open and close the door to the tank, how to most comfortably lie in the tank, where a facecloth waited in case salt entered the eyes, where the light switch was placed, as well as being informed that a song played via speakers in the tank would indicate the end of an hour, the intended

length of the floatation session. Participants were offered the flexibility of leaving the tank whenever they desired, however, all participants remained in the tank for the intended duration.

Within 2 weeks of participants' final floatation-REST session a 10-point rating-scale investigating the desire to use floatation-REST again was emailed to participants. This questionnaire was electronically created using Qualtrics and was emailed to participants simultaneously with the ninth MAAS. The completion of the Rating-scale and MAAS questionnaire signified the conclusion of the experimental phase of the research.

Control Group

The participants in the Control group were organized to attend seven fortnightly, 1-hour group meditations, which were supervised by the researcher. These were held in a room of the Psychology building on the University of Canterbury campus. Group meditations were intentionally located in a different room of the Psychology building to where meditation lessons were provided to ensure that familiarity did not affect the mindfulness scores of the Control group.

The date and time of the supervised meditation was selected prior to the study. Only participants who were able to attend the group meditation were selected.

One day prior to each group meditation, participants were sent a reminder text. Once all participants had arrived and settled into their meditation positions an alarm was set for one hour, the intended length of the meditation. All participants were offered the option of leaving at any stage. However, all participants remained for intended duration.

The 10-point rating-scale investigating the desire to be involved in a group meditation in the future, post-research, was electronically sent to participants of the Control group. The Rating-scale was emailed simultaneously with the equivalent questionnaire to the Floatation group, thus the Control group received the questionnaire 11 days after their final supervised meditation. The questionnaire was electronically created using Qualtrics and was emailed alongside the ninth MAAS questionnaire. The completion of both the Rating-scale and final MAAS signified the conclusion of the research.

Design

The experiment had two independent variables: type of environment, with two between-subject levels: sensory deprived and normal sensory; and time spent meditating weekly. The primary dependent variable was the mindfulness levels of the participants. A secondary dependent variable assessed the extent to which participants meditated outside of the fortnightly sessions.

Results

Demographics

The Floatation and Control groups, which participants were randomly assigned to, were similar in the demographic components investigated. The specific demographic details for each group are outlined in Table 1.

Table 1

Baseline 1 Demographics of Participants in the Floatation and Control Group

Variable	Floatation Group (<i>n</i> = 25)	Control Group (<i>n</i> = 25)
<i>Age</i>	<i>M</i> = 28.17, <i>SD</i> =10.33	<i>M</i> = 27.12, <i>SD</i> =12.27
<i>Gender</i>		
Female	13	11
Male	12	14
<i>Religion</i>		
None	22	23
Christian	3	2
<i>Spirituality</i>		
No	6	12
Yes	19	13
<i>Employment</i>		
Student	12	12
Student & employed	1	1
Employed for work	7	8
Self-employed	2	1
Homemaker	1	2
Not employed & not looking	1	1

Not employed & looking	1	1
<i>Attraction to Participate</i>		
Meditation	9	11
Floatation-REST	0	1
Both	16	13

The Impact of Meditation Training on Mindfulness Levels (MAAS)

The participants from both the Floatation and Control group undertook Mindfulness training before dividing into their separate conditions (see Appendix C). Mindfulness levels were measured before training and after. Five participants withdrew over the duration of the study, leaving 23 in the Floatation group and 22 in the Control group. Only the results of those who remained for the entire study were included in the analyses on mindfulness levels. The analysis found mindfulness levels significantly increased post meditation training, and there was no significant difference between the groups. A mixed between-within subjects analysis of variance was conducted to assess this impact of the meditation training on mindfulness levels across two time periods, before meditation training (Baseline 1) and after meditation training (Baseline 2), for the two groups (Floatation and Control). Mindfulness, the primary dependent variable, was measured via the MAAS. No significant interaction between group and time was found, Wilks' Lambda = .983, $F(1, 43) = .761$, $p = .388$, partial eta squared = .017. A substantial main effect for time was established, Wilks' Lambda = .663, $F(1, 43) = 21.9$, $p < .0005$, partial eta squared = .337, with both groups showing an increase in MAAS scores across the two time periods (Table 2). The main effect which compared the two groups was not significant, $F(1, 43) = 1$, $p = .319$, partial eta squared = .023. Thus, the results show that the meditation training was effective at raising mindfulness levels, and there was no difference in effectiveness of the training between the Floatation and Control group.

Table 2

Pre-Meditation (Baseline 1) and Post-Meditation Training (Baseline 2) MAAS Scores (Mindfulness levels) for the Floatation and Control group

Time Period	Floatation Group			Control Group		
	n	M	SD	n	M	SD
Pre-Meditation Training						
(Baseline 1, MAAS 1)	23	3.33	.53	22	3.43	.70
Post-Meditation Training						
(Baseline 2, MAAS 2)	23	3.63	.54	22	3.88	.79

Note: MAAS scores range from 1-6, where higher scores indicate higher levels of mindfulness

The Impact of Floatation-REST on Mindfulness Levels (MAAS) Compared to Control

The primary question under investigation is whether time spent engaging in Mindfulness meditation in floatation-REST significantly increases mindfulness levels in beginning meditators, compared to those who solely meditate in a normal sensory environment. Mindfulness levels were measured fortnightly across the duration of the experiment, via the Mindful Attention Awareness Scale (MAAS). Only measures from participants who completed the study were used in analyses. The results established that the difference in mindfulness levels across the duration of the experiment were significantly higher in the Floatation group than the Control group. A linear regression was made for each participant's fortnightly mindfulness scores, beginning from the second baseline measure and finishing with the final MAAS scores. to analyse whether the dependent variable (mindfulness, measured by the MAAS) was affected differently by the two conditions (Floatation-REST and normal sensory environment). The linear regression produced a B value representing the slope of the line relating MAAS scores to weeks of the research for each participant. A t-test found a significant difference between the B values for the Control group ($M = .02$, $SD = .06$) and the Floatation group ($M = .07022$, $SD = .08$; $t(43) = 2.37$, $p = .023$, two-tailed). The magnitude of the differences in the means (mean difference = .052, 95% CI: .008 to .096) was large (eta squared = .07). Figure 1 shows the

progression of the average MAAS (mindfulness) scores for each condition (Floatation and Control) over 16 weeks, beginning at the end of the meditation lessons (Baseline 2). Interestingly, mindfulness levels of the Floatation-REST group began at a lower level than the Control group, however this difference was not significant (see: *The impact of meditation training on mindfulness levels [MAAS]*). The difference across the duration of the research was significant, with the Floatation-REST group showing greater increases in mindfulness levels, compared to the control.

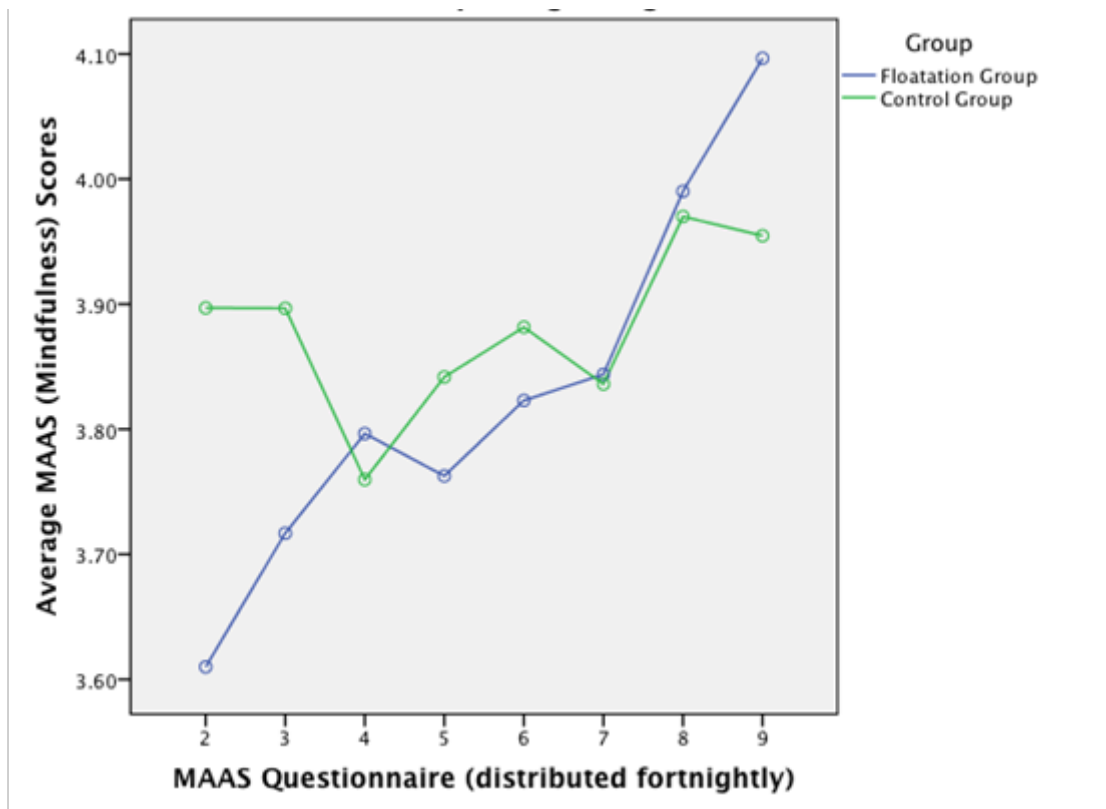


Figure 1. The progression of MAAS (mindfulness) scores for the Floatation-REST and Control group beginning at Baseline 2

Meditation Logs

It was hypothesized that engaging in Mindfulness meditation during floatation-REST would impact on participants' willingness to engage in meditation in a normal sensory environment. Both groups were instructed to engage in a 30-minute meditation daily, throughout the duration of the research. While this was the intended length and amount of individual meditation, variations of adherence to instructions have a tendency to occur. To account for the differences in individual meditation times all participants documented how long and often they engaged in an individual meditation. When meditation logs were not returned 0 hours was entered. Analysis found that there was no significant difference between the two groups' meditation times for the experiment. An independent samples t-test was utilized to compare the total individual meditation times for both groups. No significant difference was found between individual scores summed over all for the Floatation group ($M = 21.74$ hours, $SD = 11.18$) and the Control group ($M = 19.01$

hours, $SD = 11.88$; $t(43) = .795$, $p = .43$, two-tailed). The magnitude of the differences in the means (mean difference = 2.73, 95% CI : -4.20 to 9.67) was large (eta squared = .24). Thus, the hypothesis that engaging in Mindfulness in floatation-REST would affect participants' willingness to meditate in a normal sensory environment was not confirmed. Participants from both the Floatation group and the Control group engaged in equivalent hours of individual meditation.

The administered meditation logs allowed space for participants to document difficulties they experienced in regards to their daily 30-minute individual meditations (in a normal sensory environment). Reasons which stopped participants from meditating (see Table 4), reasons which caused participants to cease part-way through their meditation (see Table 5), and difficulties which were experienced during their meditation (see Table 6) were all recorded. Upon completion of the research these details were coded into the following categories: Too busy; Physical, mental or emotional state not ideal for meditating (PME); Lack of motivation to meditate; Forgot to meditate; and Environmental conditions not ideal for meditating. The records were coded by both the researcher and an independent coder.

Table 4

Most Frequent Reason for not Meditating Daily for each Participant during the First and Second Half of the Experimental Phase

Control Group		Floatation-REST Group	
First Half	Second Half	First Half	Second Half
Too busy (19)	Too busy (14)	Too busy (14)	Too busy (11)
PME not ideal (2)	PME not ideal (3)	PME not ideal (6)	Environment (7)
Motivation lack (1)	Motivation lack (3)	Motivation lack (2)	Motivation lack (2)
Forgot (1)	Forgot (2)	Forgot (2)	Motivation lack (2)
Environment (0)	Environment (0)	Environment (1)	Forgot (0)

Note: number in brackets represents the number of times the particular variable was a participants' most frequent reason for not meditating.

Table 5

Most Frequent Reason for Stopping part-way through Intended 30-minute, Daily, Individual Meditation for each Participant during the First and Second Half of the Experimental Phase

Control Group		Floatation Group	
First Half	Second Half	First Half	Second Half
Environment (7)	Environment (7)	PME not ideal (9)	PME not ideal (7)
PME not ideal (5)	PME not ideal (5)	Environment (5)	Environment (6)
Motivation lack (4)	Motivation lack (3)	Too busy (5)	Too busy (5)
Too busy (2)	Too busy (3)	Motivation lack (4)	Motivation lack (5)

Note: number in brackets represents the number of times the particular variable was participants' most frequent reason for stopping part-way through a meditation.

Table 6

Most Frequent Difficulties that arose for each Participant during Daily 30-minute Individual meditations in the First and Second Half of the Experimental Phase

Control Group		Floatation Group	
First Half	Second Half	First Half	Second Half
Environment (7)	PME not ideal (8)	PME not ideal (13)	PME not ideal (12)
PME not ideal (6)	Environment (4)	Environment (6)	Environment (8)
Motivation lack (3)	Motivation lack (3)	Motivation lack (2)	Motivation lack (0)

Note: number in brackets represents the number of times the particular variable was a participants' most frequent reason for stopping part-way through a meditation

Willingness to Engage in Floatation-REST or Group Meditation Post-Research (Rating-Scale)

Marking the culmination of the experiment participants from the appropriate groups completed a 10-point rating-scale measuring the likelihood of engaging in an hour floatation-REST session or group meditation outside of the research (see Appendix G). Available answers on the scale ranged from: 0 – I definitely would not, 5 – I'm unsure, 10 – I definitely would. Answers from the Floatation group indicated a strong likelihood of engaging in Floatation-REST again ($M = 7.73$, $SD = .47$), while the Control groups responses ($M = 4.75$, $SD = .50$), indicated an ambivalence towards engaging in a group meditation post-research. An independent samples t-test found the difference between responses of the Control group ($M = 4.75$, $SD = .50$) and the Floatation group ($M = 7.73$, $SD = .47$; $t(37) = 4.33$, $p < .0005$, two-tailed) to be significant. The magnitude of the differences in the means (mean difference = 2.99, 95% CI: 1.59 to 4.38) was large (eta squared = .34). This showed the floatation-REST groups willingness to engage in floatation-REST post research was significantly higher than the willingness of the Control group to engage in a group meditation once the research had culminated.

Preference for Individual or Group Meditation (Rating-Scale)

During the initial meditation lessons the researcher received feedback that numerous participants found meditating in a group easier than meditating alone. A 10-point rating scale was developed to measure whether this was a common experience. The following scores represented the subsequent experience: 0 – Group meditation is significantly harder than individual meditation, 5 – Group meditation and individual meditation are about the same, 10 – Group meditation is significantly easier than individual meditation (see Appendix F). Descriptive statistics showed an average score across participants of 8.02, median 8, and mode of 8 on the rating-scale. Table 7 displays the frequency which available answers from the rating-scale were selected by participants. These results indicate that group meditation was considered easier than individual meditation (in a normal environment).

Table 7

The Frequency of Answers Selected by the Participant Pool on the Individual versus Group Meditation Rating-Scale

Available Answer	Frequency
0 Group meditation significantly harder	-
1	-
2	-
3	1
4	1
5 Group and Individual meditation the same	4
6	-
7	11
8	14
9	5
10 Group meditation significantly easier	14

Note: -= no participants selected the relevant option

Discussion

The aim of the current study was to investigate whether engaging in Mindfulness meditation in floatation-REST increased mindfulness levels in beginning meditators beyond those achieved in a normal sensory environment. A further aim was to explore whether an increase in mindfulness levels associated with floatation-REST affected participants' meditation times in a normal environment. The results found floatation-REST to be associated with significantly larger changes in mindfulness levels than changes elicited solely from a normal environment. However, meditation practice times were unaffected by the increase in mindfulness levels associated with the use of floatation-REST.

The primary hypothesis predicted Mindfulness meditation in floatation-REST would lead to increases of mindfulness beyond those reached in a normal environment by beginning meditators. Analysis of the movement of dispositional mindfulness (B values) showed the Floatation group did experience significantly larger changes compared to the Control group. There were no differences between the groups in the following aspects: demographic components; effectiveness of the meditation training; or the number of individual hours meditated across the duration of the research. Thus, the primary hypothesis was confirmed. Mindfulness meditation in floatation-REST did increase levels of mindfulness in beginning meditators significantly beyond changes established in a normal environment.

Further results from this study suggest the differences in mindfulness levels for the Floatation group might become still higher if a design limitation was amended. The rating-scale responsible for measuring preference for individual or group meditation (see Appendix F) found an average answer of 8, where a rating of 10 indicated *group meditation is significantly easier* and 5 indicated *group meditation and individual meditation are about the same*. Thus, participants found group meditation much easier than individual meditation. This was an interesting finding given that Mindfulness meditation is typically practiced alone, and group meditations are comparatively rare. The one-hour group meditations were undertaken by the Control group to ensure any

differences found in the Floatation condition could not be attributed to extra meditation time. The group meditations were used as an alternate to monitored, individual meditations because of resource shortages. However, fortnightly, one-hour, individual meditation sessions (which were monitored to certify they occurred) would have been more representative of meditation outside the experimental setting. Given the preference for group meditation, it is possible the group setting facilitated the meditative state, which lead to higher mindfulness levels than individual meditation alone would have elicited. If the current study were designed to replicate a more typical meditation situation, the differences in mindfulness levels between the Floatation and Control group may have been even higher. It would be worthwhile for future research to test this theory by utilizing a design with three conditions: floatation-REST; group meditation; and individual meditation.

The development of mindfulness levels through meditation is believed to be “dose-related” (Siegel, Germer & Olendzki, 2009, p.11). Whereby, a small amount of Mindfulness practice develops a small amount of mindfulness and more significant hours of meditation produce greater increases in trait mindfulness. This theory originates from traditional Buddhist mindfulness frameworks and has been accepted by modern psychologists (Siegel, Germer & Olendzki, 2009). Mindfulness levels, in turn, are associated with healthy psychological functioning (Carmody & Baer, 2008). The perspective on how Mindfulness creates psychological change combines these features. The more meditation one engages in, the higher the levels of mindfulness developed which leads to greater improvements in psychological functioning (Siegel, Germer & Olendzki, 2009). Research by Carmody & Baer (2008) supports this theory. The authors demonstrated that the regular practice of Mindfulness developed mindfulness levels (Carmody & Baer, 2008). This increase of mindfulness levels directly mediated improved psychological functioning in psychological and physical symptom reduction, reduced stress and partially mediated enhancements in well-being (Carmody & Baer, 2008). In the current study, participants in the Floatation group engaged in a similar dose of meditation to those in the Control. However,

mindfulness levels were significantly higher for the Floatation group when both groups had engaged in similar hours of meditation over the same timeframe. These findings contradict the dose-related theory underpinning Mindfulness interventions. Since mindfulness levels seem to mediate the relationship between Mindfulness practice and psychological improvements it is likely that Mindful use of floatation-REST will be associated with enhanced psychological improvements. This suggests that floatation-REST is an ideal tool to use in combination with Mindfulness interventions, which aim to increase mindfulness levels and improve psychological functioning.

Findings from the current research support the idea that floatation-REST is a good environment for eliciting a state of mindfulness. This is primarily demonstrated by the significantly higher changes of mindfulness found in the Floatation group, compared to the Control group. The idea is further supported by visual interpretation of the movement of mindfulness levels across the duration of the research (Figure 1). Figure 1 depicts the average movement of mindfulness scores for both groups, from Baseline 2 until completion of the study. Referring to the timeline (appendix H) may aid understanding of the graph. Figure 1 shows that after the first group meditation, mindfulness levels for the Control group (MAAS 3) were similar to their average score post meditation training (MAAS 2). The mindfulness scores then fell below the post meditation training levels (MAAS 4). Levels gradually rose and were higher than post meditation training scores by the time MAAS 8 was completed. This pattern of mindfulness scores is understandable. The intensity of hours involved in the meditation training (where participants were being taught and guided through Mindfulness by a teacher) seemed to have a significant impact on mindfulness levels. It appears that when the structure of the teachings and the support of the Mindfulness teacher withdrew, mindfulness levels receded. As the number of individual and group hours of meditation increased, the mindfulness levels began to increase beyond the level achieved through intense training. In contrast, the average mindfulness levels for the Floatation group continued to increase after the cessation of Mindfulness lessons. The

immediate and near continuous rise in mindfulness for the Floatation group indicates that floatation-REST supported the development of mindfulness after intense immersion in meditation training.

Participant's willingness to engage in floatation-REST further supports the idea that this tool is ideal for eliciting mindfulness. At the end of the research participants from both groups completed a rating-scale indicating their willingness to engage in the treatment they were assigned to (floatation-REST or group meditation) (see Appendix G) The average answer from the Control group sat just below *I'm unsure*, towards *I definitely would not*. However, the average answer from the Floatation group sat over half-way towards *I definitely would* from *I'm not sure*. The Floatation groups' average answer was significantly higher than the answer average of the Control. As discussed previously, participants rated group meditation to be easier than meditating alone in a normal sensory environment. These findings combined suggest floatation-REST may be a better environment for practicing Mindfulness than group meditation, which was considered easier than meditating alone in a normal sensory environment (the typical situation for practicing Mindfulness). Further research is needed to follow up this suggestion. The rating-scale regarding individual and group meditation was completed during the initial meditation lessons, whereas the rating-scale regarding desire for group-meditation post-research was completed at the end of the study. It is possible that during the first few weeks of learning Mindfulness, meditation in a group setting is easier. As hours of individual meditation increase, and the practitioner becomes more adept at meditating alone, the desire for group meditation may decrease. Regardless, the findings of this study establish that participants who have experienced floatation-REST are willing to continue its use. The willingness to use floatation-REST further supports this tool as an good environment for eliciting mindfulness.

Information gathered from participants' meditation logs further support floatation-REST as a good environment for meditation. The meditation logs were completed by all participants throughout the duration of the research. They documented how long participants meditated for,

reasons for not meditating, reasons for stopping part-way through a meditation and any difficulties that arose during meditation sessions. Table 4 shows that during the first half of the experiment *environment* was the top reason for not meditating for only one participant in the Floatation group. No participant from the Control group experienced it as their primary deterrent in the first half. This trend for the Control group continued in the second half, where again, no participant ranked the environment as their top reason. For the Floatation group, however, the environment rose to the top reason for not meditating for seven participants. This elevated environment to the second most important reason deterring participants in the Floatation group from meditating during the second half of the experiment. By the second half of the experiment, the Floatation group had experienced at least three sessions in floatation-REST. These findings suggest that participants may have found floatation-REST a good environment for meditating in, and made them less willing to meditate in a normal sensory environment. But while grievances with the normal environment became more salient for participants in the Floatation group, this did not hinder their meditation in general. This is demonstrated by the Floatation group and Control group meditating for statistically similar hours =throughout the research. It may be practically important that meditators who use floatation-REST continue to meditate in a normal environment and do not become dependent on the tool. Floatation-REST may not always be available.

Difficulties with the environment were also experienced during meditation sessions, often causing participants to cease meditation early. Table 6 shows *environment* was the top difficulty experienced by the Control group in the first half of the experiment and the second most difficult aspect of meditation in the second half. For the Floatation group, the environment was experienced as the second highest difficulty during meditation sessions in both the first and second half of the study. The difficulty experienced with meditating in a normal sensory environment was the most frequent reason for participants in the Control group to stop their meditation sessions part-way through (Table 5). It was the second most frequent reason for

causing participants in the Floatation group to cease their meditation part-way through the intended time. These findings further highlight the difficulty that beginning meditators experience when meditating in a normal environment. The difficulties with the environment experienced by beginning meditators are likely quelled by meditating floatation-REST, an environment with a more comfortable, stable and less distracting environment.

The field of research associated with floatation-REST is relatively small. A lot remains unknown about this tool. The idea that floatation-REST may be associated with mindfulness was reached through the compilation of various pieces of evidence. Turner & Fine's (1993) paper postulates that an attitude of acceptance enhances the benefits of floatation-REST and after several floatation-REST sessions attitudes tend to naturally move towards acceptance. While there is debate over how acceptance is related to mindfulness, it is believed that mindfulness either subsumes an acceptance of the present moment (Brown & Ryan, 2003) or that acceptance is a separate component of mindfulness (Kabat-Zinn, 2013). Turner & Fine's (1993) theory of floatation-REST can be mapped onto a theory of mindfulness, suggesting floatation-REST works through eliciting mindfulness. The acceptance factor emphasized by Turner & Fine (1993) fulfils the passive attitude condition of the relaxation response (Wallace & Benson, 1972). Floatation-REST meets the other two major conditions of the relaxation response by providing a sensory reduced environment and allowing the user to assume a comfortable position (Wallace & Benson, 1972; Ben-Menachem, 1977; as cited by: Bood, 2007). The relaxation response is a mechanism associated with mindfulness. Physiological markers of the response include a reduction in blood pressure, which leads to an alteration in cortisol. Furthermore, self-reports of thinking and attending styles in floatation-REST suggest a tendency to focus on the present moment. Attending to the present moment is the focus of Mindfulness meditation and is believed to be made possible because of mindfulness as a faculty of consciousness. This combination of research indicates floatation-RESTs potential for eliciting mindfulness. The findings from the current study

demonstrate that REST is a good environment for increasing mindfulness, when Mindfulness is practiced during floatation sessions.

The secondary hypothesis of the current study was not confirmed. Individual meditation times in a normal sensory environment for the Floatation-REST group were predicted to be significantly different than those of the Control group. As previously discussed, the theory underpinning Mindfulness interventions is that they are dose-related, and the extent of Mindfulness practice is correlated with the amount of mindfulness developed (Siegel, Germer & Olendzki, 2009). However, by predicting that floatation-REST would increase mindfulness levels beyond dose-related levels (hypothesis one), the researcher was uncertain how meditation times in a normal sensory environment would be affected. Significant increases in mindfulness levels could have either encouraged or discouraged meditation in a normal sensory environment. However, there was no statistical difference between the meditation hours of the two groups. As discussed previously, increased use of floatation-REST was associated with an increased tendency to not meditate due to difficulties with the normal sensory environment (Table 4). However, this difficulty did not hinder the Floatation group from engaging in equivalent hours of individual meditation as the Control group. It is possible that both effects were present but they cancelled each other out in the average result.

The design of the current study was limited by a number of factors. Firstly, the participants in the Control group spent the one-hour group meditation sitting. While they were allowed to move and stretch as they pleased, there was an unspoken consensus that they would resume a seated position when they were ready. The group meditation was double the length participants were used to meditating for individually. The increase in meditation length may have caused heightened physical discomfort for the Control group. This physical discomfort may have caused resistance in the participants, and made their Mindfulness practice more difficult. Meanwhile, the participants in the Floatation group were meditating in a comfortable position. This limitation was considered post-research when the design of the study could not be altered. It would be

beneficial for future research to utilize a similar design to this study, yet have the Control group lying down during one hour meditations.

Additionally, the researcher was responsible for monitoring the group meditation for the Control, and greeting participants of the Floatation group before their Floatation-REST sessions. It is possible that knowing the hypotheses of the study altered the researcher's engagement with the different groups, which subsequently affected their mindfulness ratings. This limitation was unable to be controlled for with the resources allocated to the present study. It may be worthwhile for future research to employ overseers who are unaware of the study's predictions.

Another potential limitation of the research was featuring both Mindfulness training and floatation-REST on the advertisement for participants. The advertisement therefore associated REST with mindfulness. This association may have lead participants to expect REST to increase mindfulness. This expectation may have altered how participants in the Floatation group rated their levels of mindfulness. Given that REST and Mindfulness training were the two major components of the study, however, both aspects needed to be advertised.

Another limitation of the current study is the teaching of a general Mindfulness-based meditation, rather than a standardized Mindfulness-based intervention. It is possible that the way Mindfulness was taught was more easily applied to a floatation-REST setting than other Mindfulness approaches may be. This limitation was due to the availability of a Mindfulness teacher and the lack of resources to employ a teacher of a standardized method. It would be beneficial for future research to utilize a standardized method (such as Mindfulness Based Stress Reduction) so results are more easily replicable.

A further limitation of the current study is the general difficulty associated with defining and measuring mindfulness. The debate over what defines mindfulness and how it should be measured has been discussed in detail. As the research into mindfulness continues it is possible these issues will be resolved. If a consensus on measuring mindfulness is established this study should be replicated using the appropriate measures.

The current research demonstrates floatation-REST has the capacity to significantly increase mindfulness levels in beginning meditators when Mindfulness meditation is engaged in during floatation-REST sessions. These findings raise the question of how floatation-REST produces this effect. A few theories are plausible. It is possible that after experiencing such a large reduction in sensory information, users of floatation-REST may be more aware of and interested in their sensory experience of the normal environment. Paying attention to sensory experience, rather than being involved in cognitive elaborations of the sensory experience, is mindfulness. Therefore, it is possible that floatation-REST enhances mindfulness by altering users attending styles to focus on their senses once they leave floatation-REST.

It is similarly feasible that floatation-REST increases the depth of meditation achieved while floating. *Depth* is a term commonly used by Mindfulness meditators to refer to the expansiveness of their awareness during a meditation session. If floatation-REST facilitates a deeper meditative experience, it is possible the enhancement of awareness would carry over into a normal sensory environment and be maintained by meditation in that environment. There are various mechanisms through which a deeper meditation may be achieved in floatation-REST. The current research utilized beginning meditators. People new to meditation can find sitting for an extended period of time, physically uncomfortable and are prone to being distracted. In the comfortable, distraction-free environment of floatation-REST the meditator may be able to stay more present to their experience, thus deepening their meditation. Furthermore, floatation-REST may have a tendency to elicit a state of mindfulness, without the user intentionally meditating. The mechanisms through which floatation-REST is increasing mindfulness levels in Mindfulness meditators is an avenue for future research.

The results of the current research do not determine whether mindfulness levels are increased by floatation-REST itself. If participants were not using a Mindfulness technique that reduces cognitive elaboration the situation may have been quite different. If an individual had a high level of mind-wandering or tendency to ruminate floatation-REST may exacerbate these thinking styles

by removing tasks or distractions that might typically attenuate them. Simultaneously, if another individual had a tendency to be aware of their present moment experience (i.e. had a naturally high level of mindfulness) floatation-REST may increase this tendency by reducing the amount of stimuli to be present to. Thus, it may be that floatation-REST alone does not evoke mindfulness in all users, but does in those with a natural propensity for the state, or in those who are intentionally eliciting it (as seen in this research). To continue establishing floatation-REST's relationship with mindfulness it would be beneficial for future research to explore the technique's impact on meditation naïve participants, while measuring dispositional mindfulness as well as tendencies to ruminate and mind-wander.

The current research examined the effects of floatation-REST on beginning Mindfulness meditators. As discussed, floatation-REST may have facilitated enhanced levels of mindfulness in this group by providing them with a comfortable, distraction-free environment. The aim of Mindfulness meditation is to enhance the practitioner's ability to be aware of every aspect of experience. Thus, in the more developed stages of the practice there are no experiences that are considered distractions, including physical discomfort. Graph 1 shows the scores of the Control group steadily increasing. Given more time, their mindfulness levels may have become equivalent to those in the Floatation group. It is possible that increases in mindfulness levels through the use of floatation-REST are only found in beginning meditators. It would be worthwhile for future research to construct a longitudinal version of the current research, or use experienced Mindfulness meditators.

As previously discussed, mindfulness theory and research suggests the amount of hours spent meditating increases levels of mindfulness, which in turn, improves psychological functioning (Siegel, Germer, Olendzki, 2009; Carmody & Baer, 2008). This is the theory underpinning Mindfulness-based psychological interventions. Mindfulness-based interventions are widely used and their popularity is continuing to grow. Importantly, the current study shows floatation-REST can enhance mindfulness levels beyond a dose-related amount in beginning Mindfulness

meditators. Given that mindfulness levels directly mediate the relationship between meditation practice and psychological improvements (Carmody & Baer, 2008) it is likely that the increases in mindfulness elicited from floatation-REST would be associated with psychological improvements in a reduced amount of time as well. This is an important avenue for future research to explore.

In conclusion, this study revealed floatation-REST can enhance levels of mindfulness in beginning Mindfulness meditators, beyond the levels developed in a normal sensory environment alone. The significant enhancements of mindfulness levels were established despite both experimental groups engaging in similar hours of meditation. This finding contradicts the theory that improvements in mindfulness are dependent on the amount of meditation undertaken. It is well-established that higher levels of mindfulness are associated with greater psychological improvements. Nevertheless, future research is needed to ascertain whether the enhancement of mindfulness through floatation-REST is associated with similarly increased psychological benefits. This research demonstrates that floatation-REST can be used in combination with Mindfulness-based interventions to develop and cultivate mindfulness over a smaller period of time.

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Appendix A



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffiths
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/41

28 June 2013

Vicky Campion
Department of Psychology
UNIVERSITY OF CANTERBURY

Dear Vicky

The Human Ethics Committee advises that your research proposal "The effects of meditation on mindfulness" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your emails of 17 and 27 June 2013.

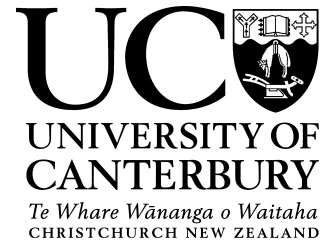
Best wishes for your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair
University of Canterbury Human Ethics Committee

Appendix B



Department of *Psychology*

Consent Form

The Effect of Meditation on Mindfulness

I have read and understood the description of the above-named project. On this basis I agree to voluntarily participate as a subject in the project, and I consent to publication of the results of the project with the understanding that anonymity will be preserved.

I understand also that I may at any time withdraw from the project, including withdrawal of any information I have provided, up until December 1st 2013.

I note that the project has been reviewed *and approved* by the University of Canterbury Human Ethics Committee.

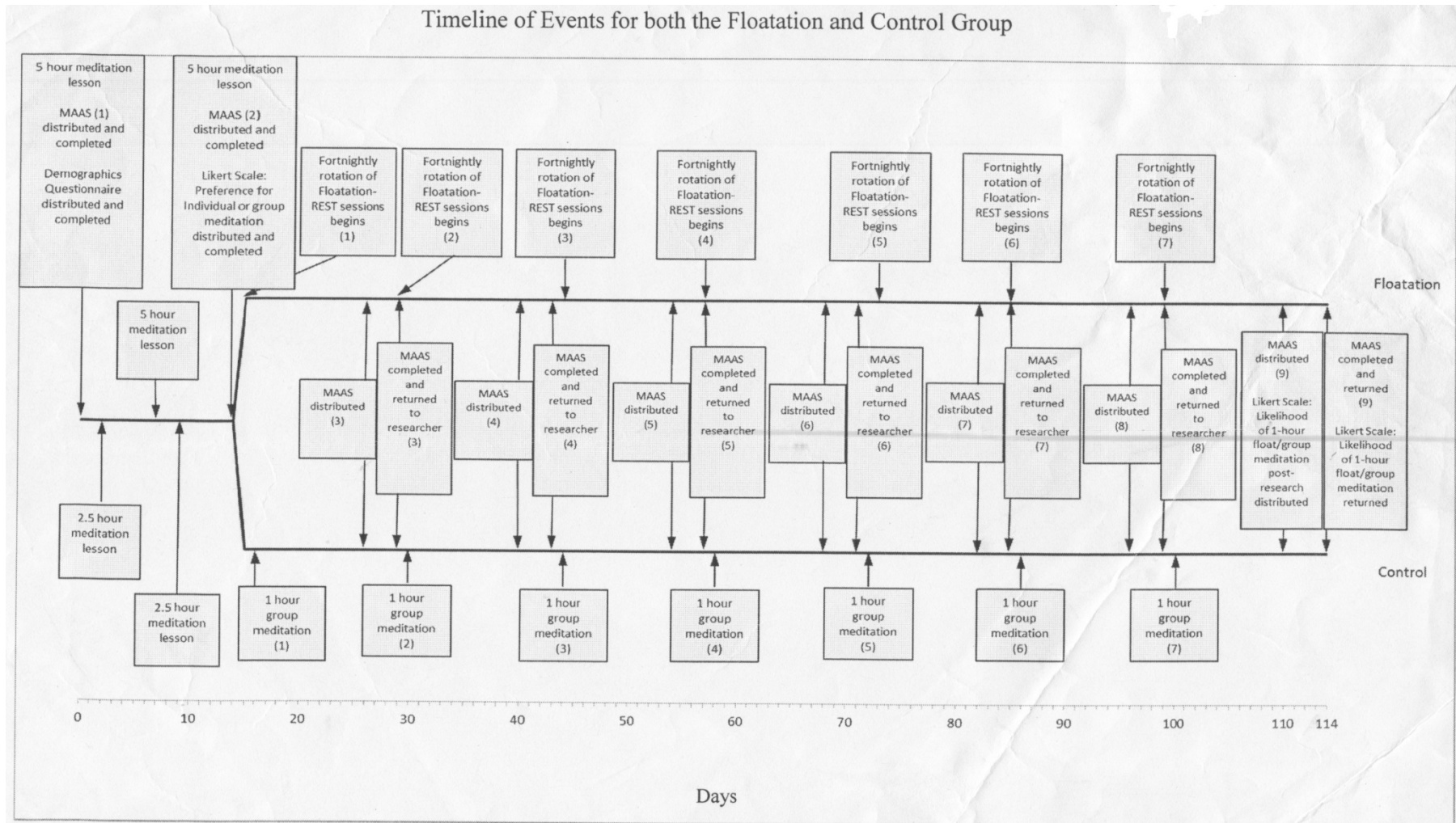
NAME (please print):

Signature:

Date:

Researcher:
Vicky Champion
vicky.champion@pg.canterbury.ac.nz

Appendix C



Note: From day 1 until day 114 participants from both the Floatation and Control group were instructed to meditate for 30 minutes a day in a normal sensory environment, excluding days that a meditation lesson, group meditation or Floatation-REST session were scheduled.

Appendix D

Demographics Questionnaire

Name:

Age:

Gender:

Are you religious?

If so, what religion are you affiliated with?

Do you consider yourself spiritual?

Please select the employment status that best suits your situation:

Student

Student and employed

Employed for work

Self-employed

Homemaker

Not employed and not looking

Not employed and looking

Please indicate what attracted you to participate in this research:

Meditation

Floatation-REST

Both

Appendix E

Mindful Attention and Awareness Scale (MAAS)

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6

1 Almost Always	2 Very Frequently	3 Somewhat Frequently	4 Somewhat Infrequently	5 Very Infrequently	6 Almost Never
I drive places on 'automatic pilot' and then wonder why I went there.					
				1	2
				3	4
				5	6
I find myself preoccupied with the future or the past.					
				1	2
				3	4
				5	6
I find myself doing things without paying attention.					
				1	2
				3	4
				5	6
I snack without being aware that I'm eating.					
				1	2
				3	4
				5	6

MAAS Scoring

To score the scale, simply compute a mean of the 15 items. Higher scores reflect higher levels of dispositional mindfulness.

Appendix F

How have you found meditating in a group in comparison to meditating on your own?
Please circle your answer.

0 – Significantly harder

1

2

3

4

5 – About the same

6

7

8

9

10 – Significantly easier

Appendix G
Rating-Scale for Floatation Group

Now that you have reached the end of this research, how willing are you to use floatation-
REST again?

Please circle your answer.

0 – I definitely would not

1

2

3

4

5 – I'm unsure

6

7

8

9

10 – I definitely would

Rating-Scale for Control Group

Now that you have reached the end of this research, how willing are you to engage in a group meditation again?

Please circle your answer.

0 – I definitely would not

1

2

3

4

5 – I'm unsure

6

7

8

9

10 – I definitely would